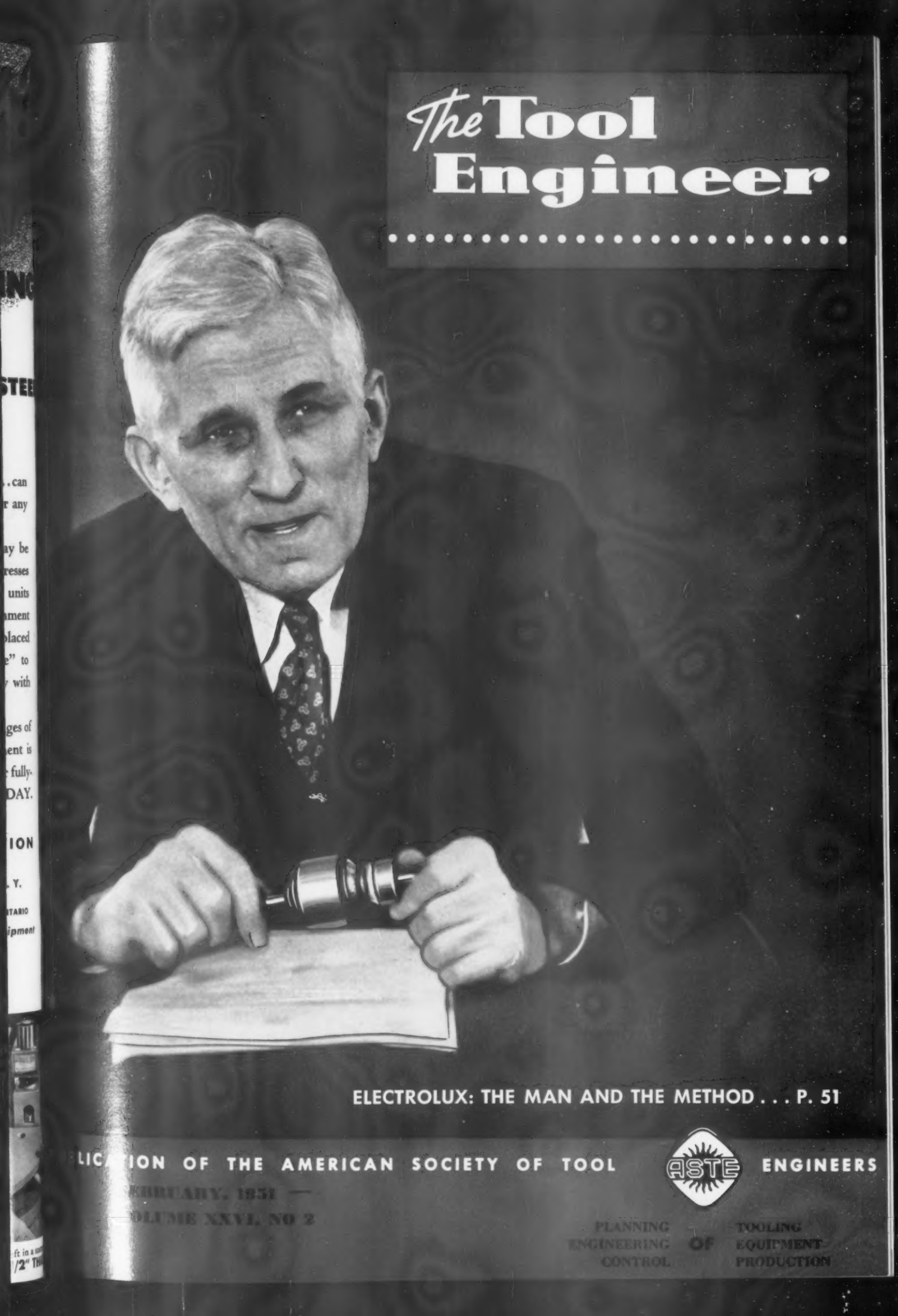
The Tool Engineer
ELECTROLUX: THE MAN AND THE METHOD . . . P. 51
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VOLUME XXVI
NUMBER 2
FEBRUARY, 1951

The Tool Engineer

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AMERICAN SOCIETY OF TOOL ENGINEERS

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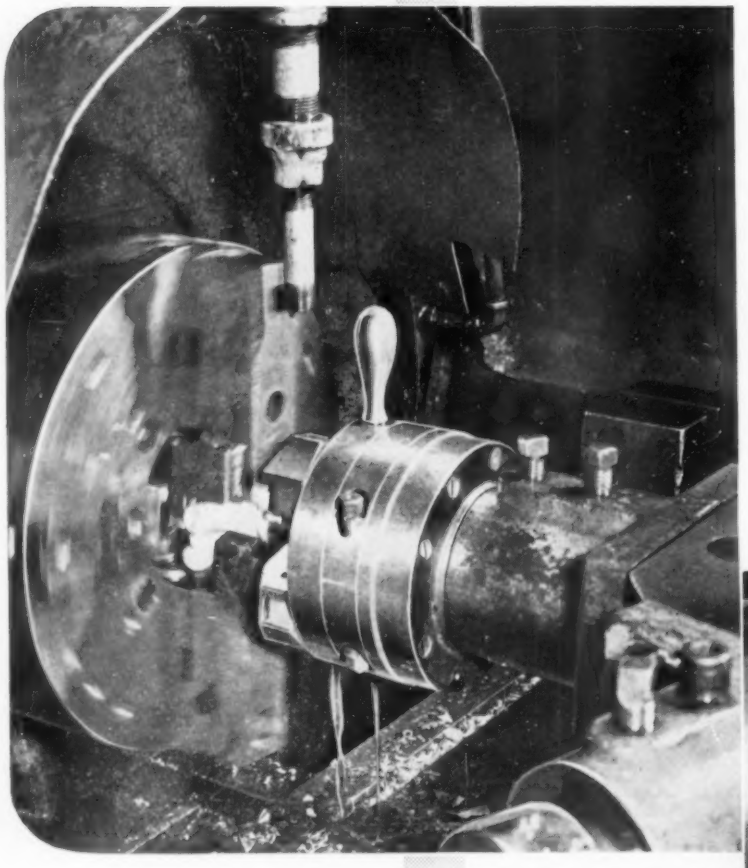
GOOD LEAD *on* THREADS

WITH LANDMATIC HEADS



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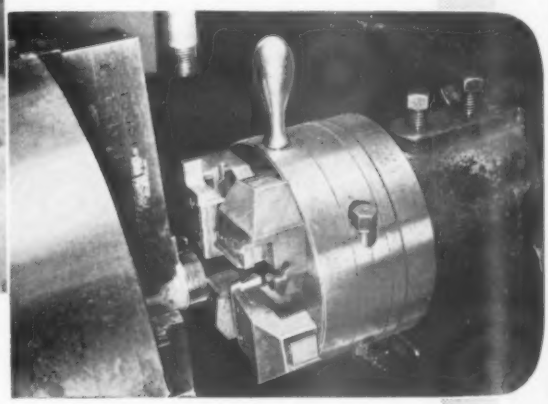

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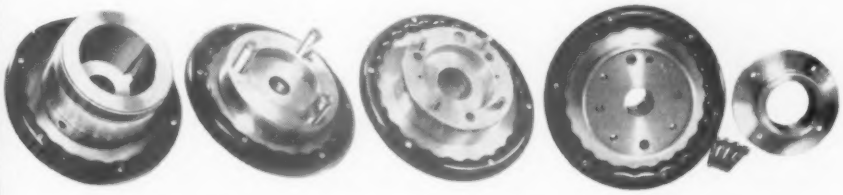

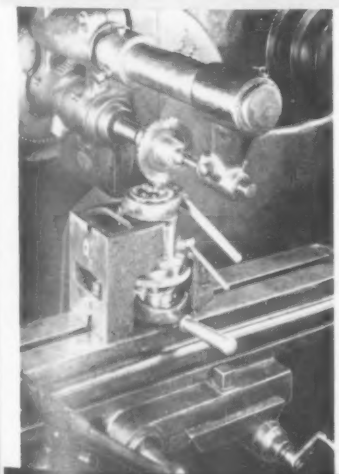

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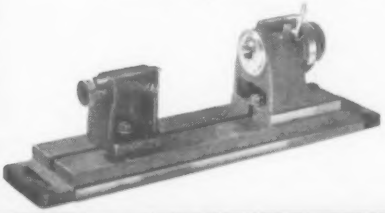

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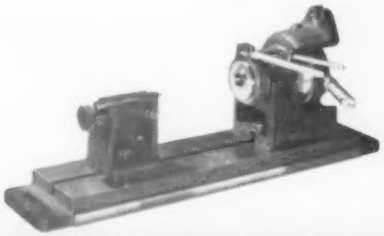

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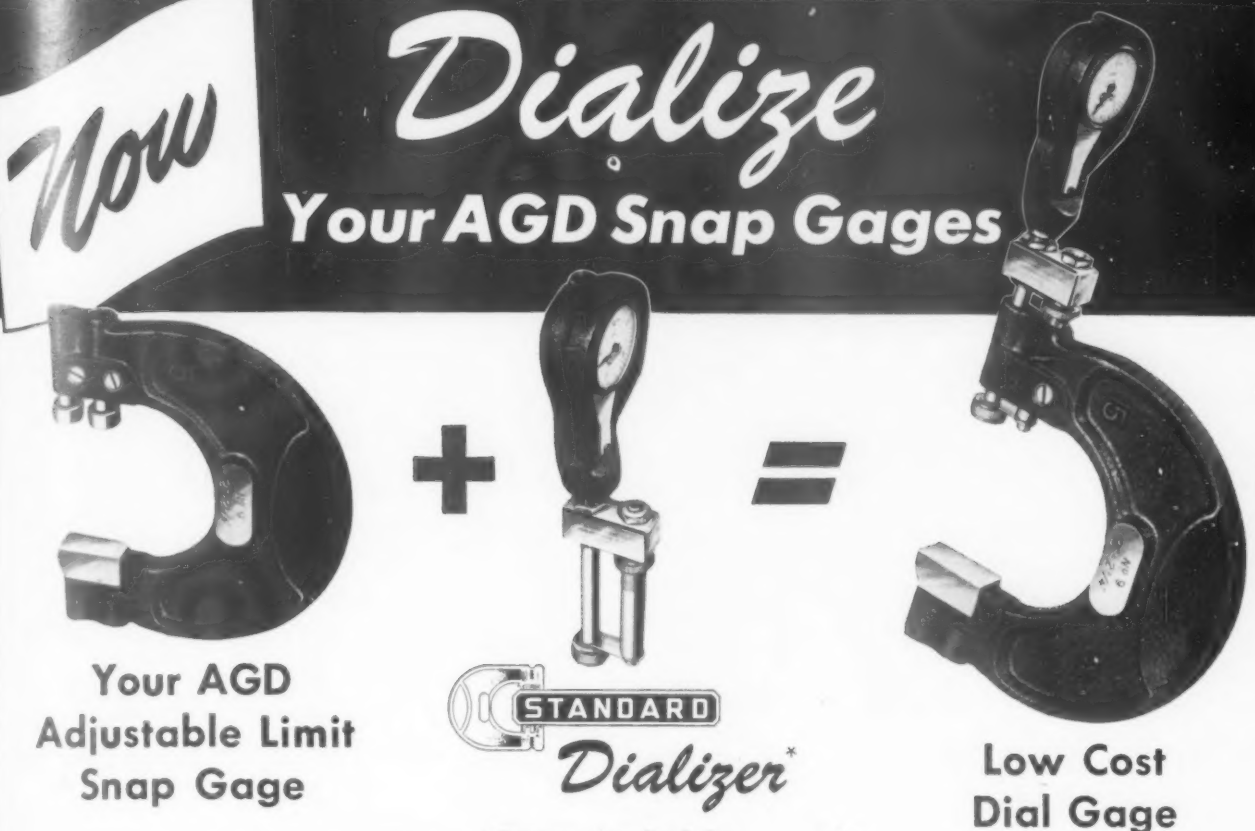

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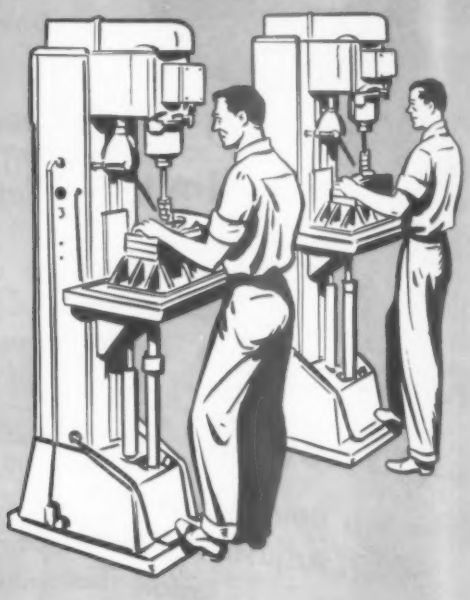

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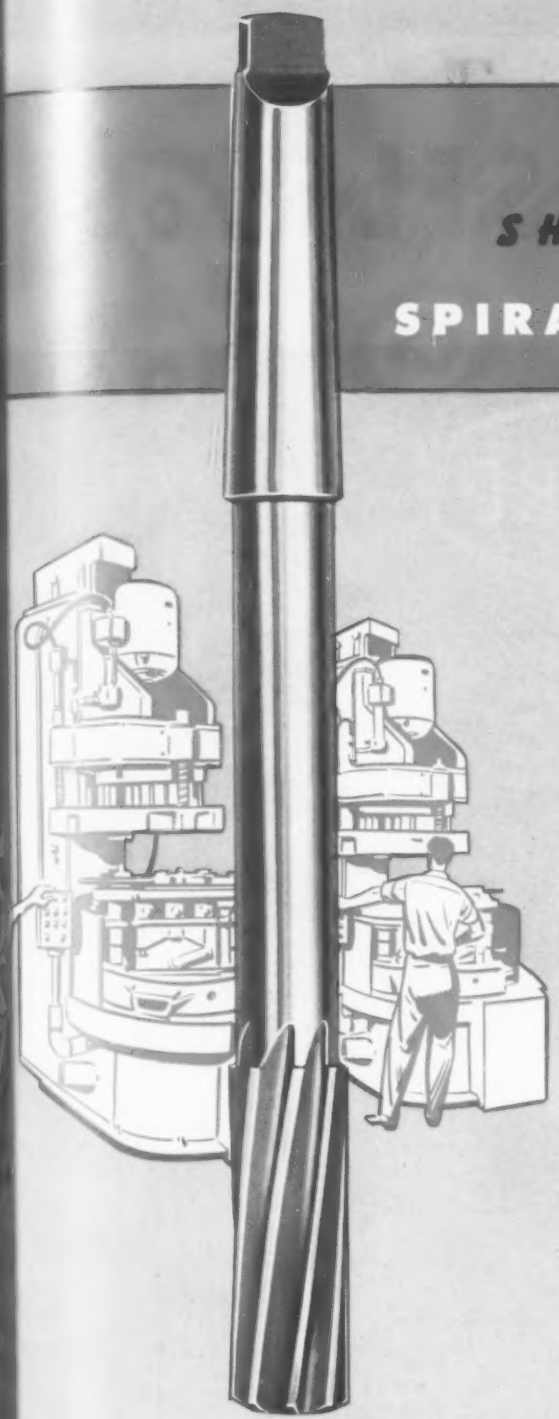

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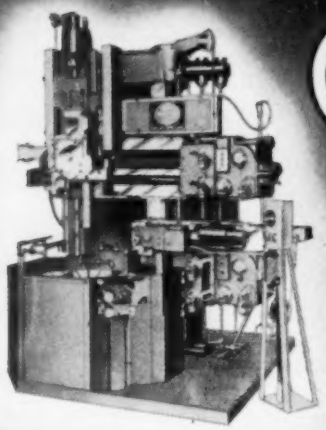
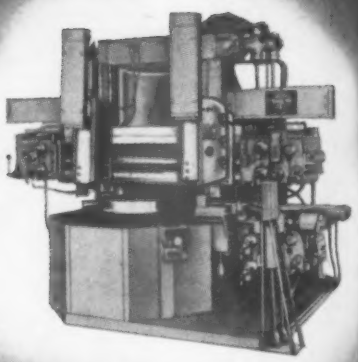
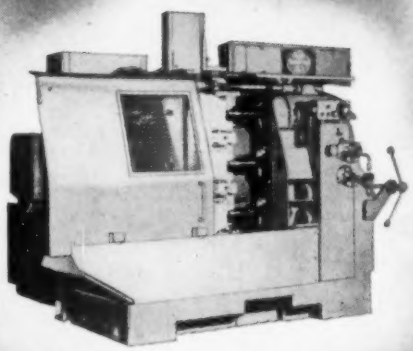


36" Man-Au-Trol Vertical Turret Lathe

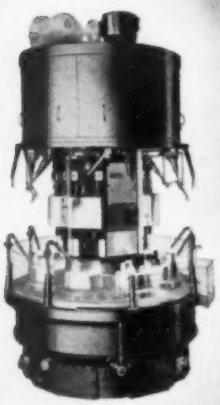
Man-Au-Trol V. T. L.'s in six sizes 30" — 36" with two heads 42" — 54" — 64" — 74" with three heads



54" Man-Au-Trol Car Wheel Lathe

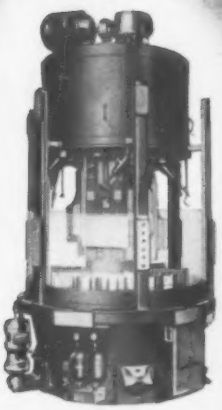


Man-Au-Trol 3 Spindle Horizontal Lathe

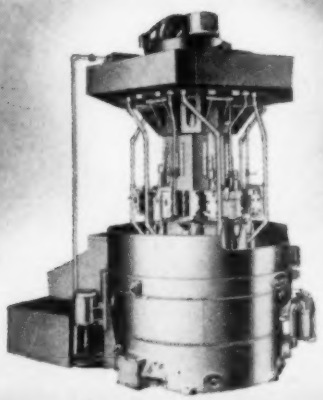


Mult-Au-Matic Type "D"

Mult-Au-Matic Type "D" 8" — 12" — 16" with 6 or 8 spindles, Type "D" 16-23 and Type "K" 6 spindles — twin 6 spindles — 8 spindles and twin 8 spindles



Mult-Au-Matic Type "K"



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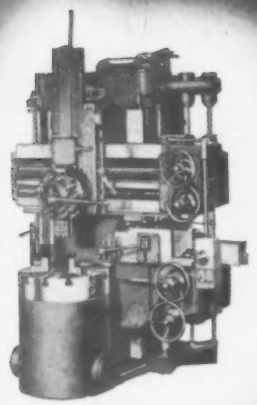
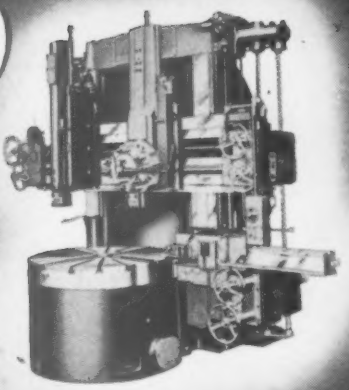
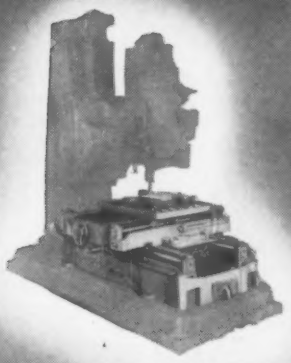


30" Cut Master Vertical Turret Lathe



54" Cut Master Vertical Turret Lathe



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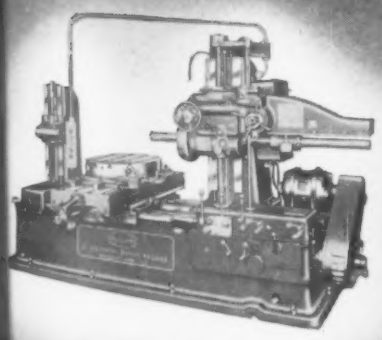

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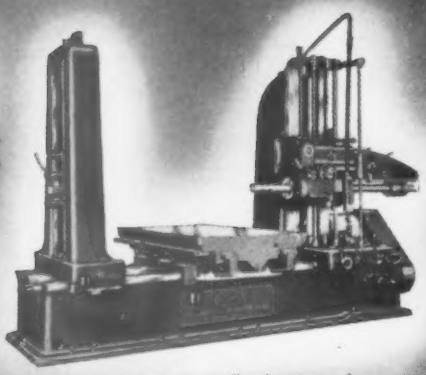

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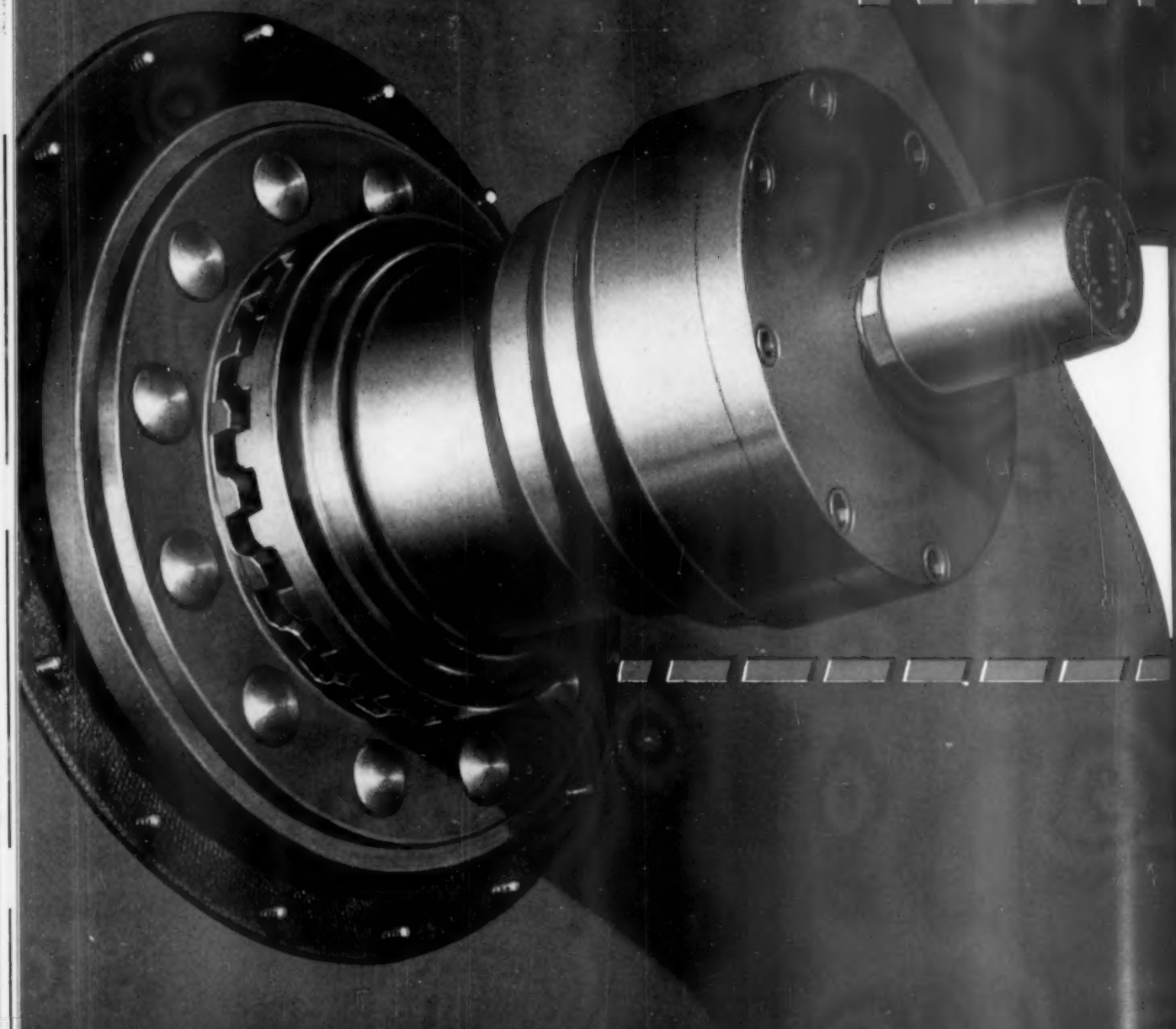

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13 Provides effortless operation.
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15 Can be completely removed without taking off the drive wheel.
16 Drive wheel next to frame . . . minimum overhang.
17 Drive wheel runs on antifriction bearings.
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19 Has few moving parts. Integral jaws and splines.
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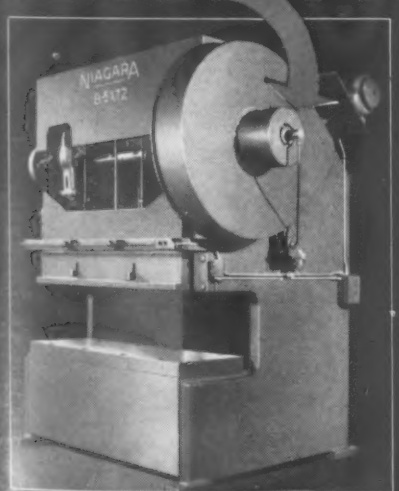

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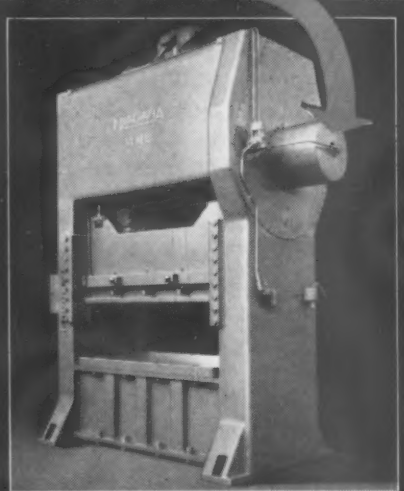

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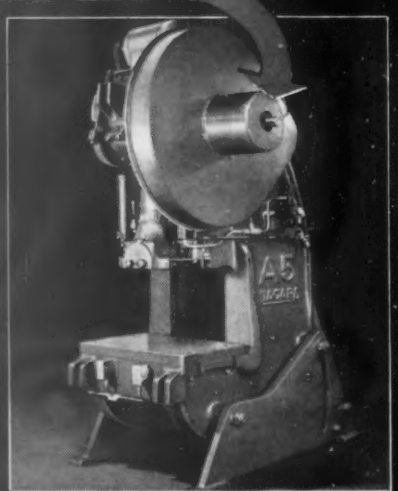

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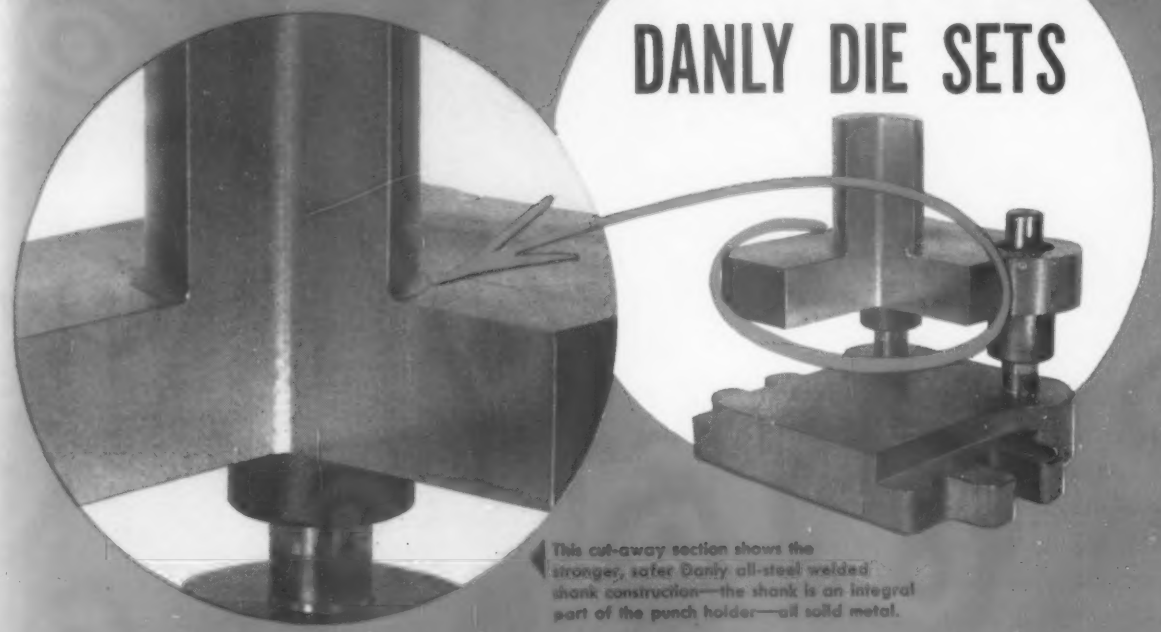
This quality feature is STANDARD construction on all-steel shank type

DANLY DIE SETS



This cut-away section shows the stronger, safer Danly all-steel welded shank construction—the shank is an integral part of the punch holder—all solid metal.

DANLY INTEGRAL WELDED SHANK

A new welding technique that assures 100% fusion of shank to punch holder makes this superior construction possible. Knock out holes in the shank itself or machining on the punch holder face are much less likely to effect shank strength.

Features like this make Danly the nation's leading die set producer. Check these other Danly Die Set advantages and you'll see why die makers and production men everywhere prefer Danly Die Sets:

- *prompt delivery* . . . from the nearest of the nation wide system of Danly assembly branches.
- *precision construction* . . . leader pins and bushings hardened and ground to precision tolerances and lapped after assembly to provide a smooth running fit.
- *broad selection* . . . the wide range of Danly standard and stocked special die sets meets nearly every tooling need.
- *Danly reliability* . . . every Danly Die Set is backed by the experience accumulated in more than a quarter century of service to the stamping industry.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois

PRECISION DIE SETS . . . STANDARD AND SPECIAL

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- SIMPLE LOADING
- AUTOMATIC CLAMPING

the American WAY

SIMPLE LOADING plus AUTOMATIC CLAMPING gives the manufacturer of these connecting rods and caps BALANCED PRODUCTION at the rate of 300 complete assemblies per hour.

The installation, engineered the American-way, consists of a Standard American 10-ton, 42-inch stroke vertical duplex hydraulic broaching machine and two, two-station fixtures mounted on completely automatic tilting-type work tables. Fixtures are interchangeable. One station on each fixture holds a rod part, the other a cap. The operator simply PLACES a rod and a cap on the first fixture . . . then pushes the control buttons. The parts are CLAMPED AUTOMATICALLY while the table tilts down and then broached. While one assembly is broached the operator loads the other fixture.

AMERICAN CAN HELP YOU SOLVE YOUR PRODUCTION PROBLEMS

Just as American has helped thousands of other manufacturers during the past twenty-five years, they can help YOU solve your production problems. For the answer to your problems send a part-print or sample and hourly requirements. Address Dept. T.

WRITE TODAY *for your copy of American's Circular No. 300 on American Vertical Hydraulic Surface Broaching Machines.*

AMERICAN **American** BROACH & MACHINE CO.

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NATCO MARKS A HALF CENTURY OF CONTRIBUTION TO INDUSTRIAL ADVANCEMENT

If you could look on the inside of thousands of manufacturing plants throughout the world, you would see NATCO machines busy drilling, facing, boring and tapping billions of large and small holes in parts destined for everything from automobiles, trucks and tramp steamers to radios, electric motors and home appliances.

All these things are a part of tremendous scientific industrial advancement made possible through the combined effort of machine tool builders and American Industry. With the turn of the half century into the atomic age of the present, every man and woman in the NATCO organization is proud of his part in this fifty-year record and glad to look ahead to the opportunity of serving industry and the forces of freedom in the years to come.

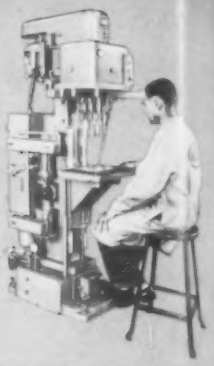
Golden Anniversary

1901 NATCO 1951

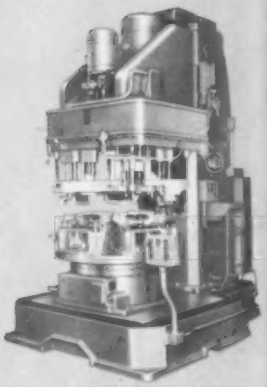
NATCO OFFERS

50 Years Experience

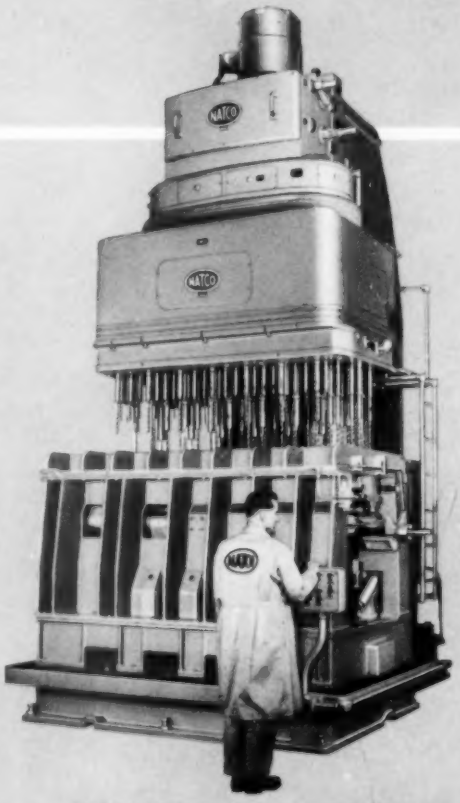
IN BUILDING A COMPLETE RANGE OF DRILLERS, BORERS, FACERS AND TAPERS



NATCO LIGHT SENSITIVE DRILLER AND TAPPER



NATCO HOLESTEEL ADJUSTABLE DRILLER AND TAPPER



NATCO HEAVY DUTY HOLESTEEL DRILLER

NATCO STATION TYPE MACHINE

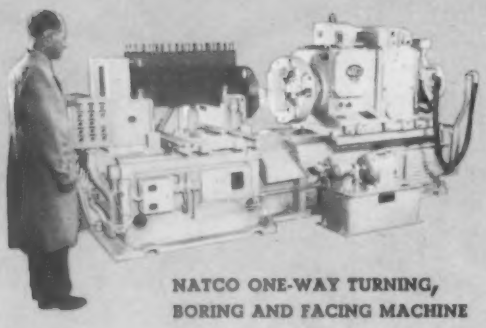
Out of the past fifty years of NATCO experience has come a deeper understanding of today's engineering and production problems.

By reason of this maturity of understanding the NATCO organization is better equipped to help you solve your drilling, boring, tapping and facing problems. Better equipped with experienced engineers and designers. Better equipped with the most complete range of adjustable and fixed center multi-spindle machines in the world.

A few of the various NATCO machines are illustrated above. As you can see they range from small, fast, light-sensitive multi-drillers and tappers to large automatic processing machines . . . from single spindle

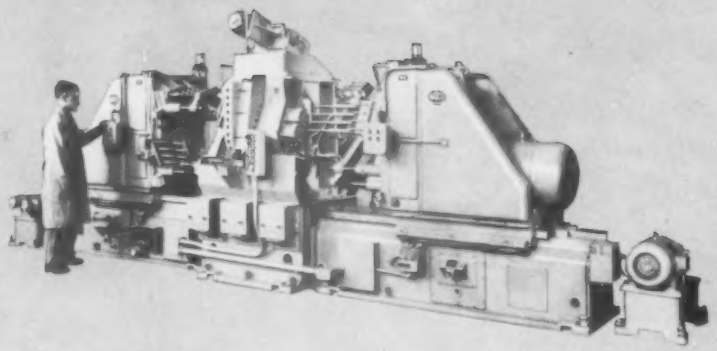
NATCO HIGH SPEED SENSITIVE
DRILLER AND TAPPER

NATCO HIGH SPEED SENSITIVE UNIT



NATCO ONE-WAY TURNING,
BORING AND FACING MACHINE

NATCO THREE-WAY TAPPER
WITH INDIVIDUAL LEAD SCREW



NATCO THREE-WAY TRUNNION
TYPE DRILLING MACHINE

NATCO HOLEWAY AUTOMATIC
PROCESSING MACHINE

to an unlimited number of spindles, from one direction to any number of directions, vertical, horizontal or angular, special or standard and operations range from 1/16" drill to 14" or larger bore. Typical materials worked include iron, steel, bronze, aluminum, wood and plastic.

Golden Anniversary

1901 NATCO 1951

NATCO production, sales and service facilities have grown also during the past fifty years to keep in step with the times.

Since 1901, from a small well organized plant, NATCO's main engineering and production buildings have been enlarged to cover an entire city block . . . and still more engineering and production space is being completed this year.

To serve you still better, NATCO maintains several complete engineering departments with full complements of engineers, draftsmen and sales and service personnel. Branch offices are conveniently located in Detroit, Chicago, Buffalo, and New York City.

And so NATCO not only offers you better machines backed by fifty years' experience, but ample production and engineering facilities.

These are the reasons why we say . . . to solve your problems in drilling, boring, facing and tapping most economically . . .

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Richmond, Indiana, U. S. A.

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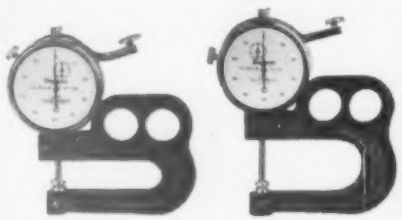
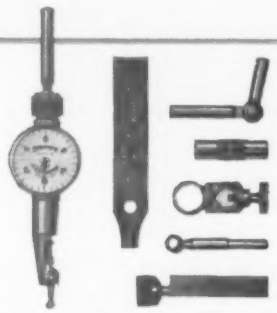
DIAL INDICATORS

These new Starrett Dial Indicators bring you dependable Starrett accuracy in a new and highly versatile form. Designed for the widest possible application to production inspection with new and exclusive Starrett features, you can count on them to bring greater efficiency and economy to your quality control operations.



STARRETT PORTABLE DIAL HAND GAGES — No. 1015-A and 1015-B

½" and 1" thickness capacities; 2½" throat. Available with direct reading or balanced dial indicators. Also with special sizes and shapes of anvils.

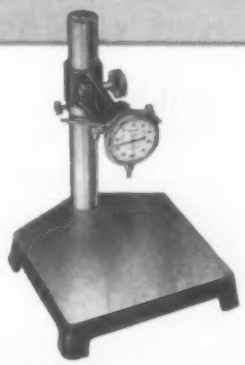


"LAST WORD" TEST INDICATOR No. 711-E

With universal friction holder and universal shank for infinite adaptability. Also features reversible action and hard chrome plated contact point with ratchet joint. Graduated .001", reading 0-15-0, range .030".

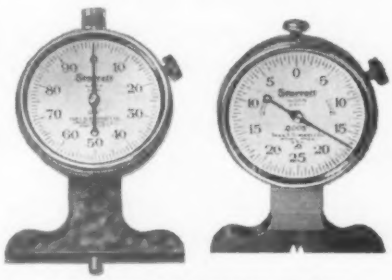
STARRETT UNIVERSAL DIAL BENCH GAGE No. 652

With sliding table and fine adjustment. Vertical capacity 1¾". Throat depth 1⅜". Indicator graduated .0005", reading 0-25-0, range .125".



STARRETT DIAL COMPARATOR No. 653

With fine vertical adjustment. Base platen 9" x 9⅝". Vertical capacity 9¼". Throat depth 5". Indicator graduated .001", reading 0-50-0, range .250".



STARRETT DIAL DEPTH GAGES

No. 644 with flat base and 11 extra rods; capacity 0-3 inches; indicator graduated .001", reading 0-100, range .250". No. 643 with knife-edge base and push-down needle point, indicator graduated .0005", reading 0-25-0, range .125".

STARRETT SHOCK ABSORBING ANVIL (Contact Point) No. 28 Patent Pending

Make all your indicators shockless at low cost. New shock absorbing point with internal spring effectively cushions impact. Standard No. 4-48 thread fits all A.G.D. indicators.

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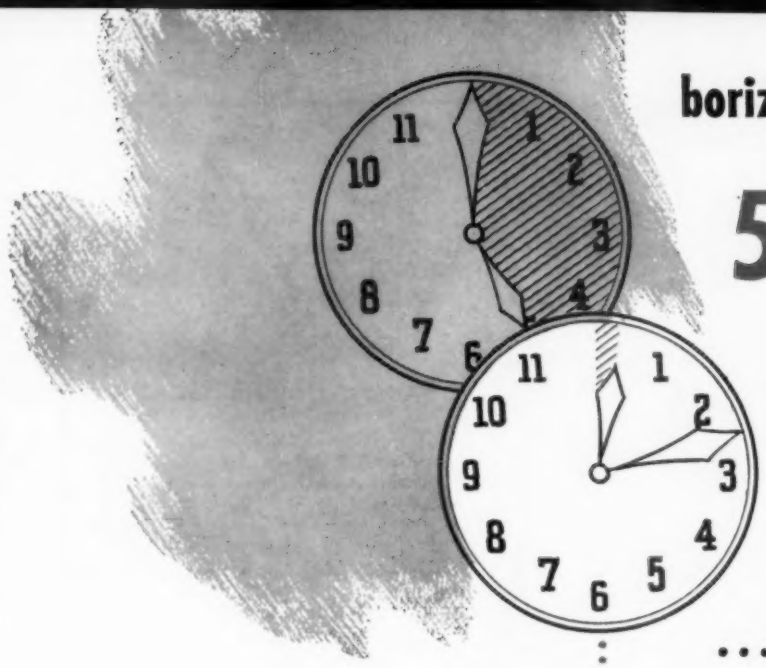

borizing time CUT FROM 5 hours to 12 minutes per piece !

...with a new, double-end Heald Bore-Matic

By performing many different operations in one high-speed, automatic cycle, the Heald Model 322 Bore-Matic shown below actually saved 4 hours and 48 minutes on each part.

On this machine, gear case covers for diesel engines are bored, faced, chamfered and turned with but a single set-up. As this job formerly required separate operations on different machines, the saving in set-up and handling time was tremendous.

A total of four boringheads are used — one on the left-hand bridge, and three on the right. The work, clamped to an angle-plate fixture, is automatically presented to the two sets of heads in sequence, after which it returns to center for reloading.

The amount of time that you can save with a new Heald machine is a measure of the time now being lost through out-dated equipment and methods. How much is this "lost time" — and what is it costing you in terms of production efficiency? Your nearest Heald representative will be glad to study your finishing operations and give you the answer — without obligation. Remember — when it comes to precision finishing, it pays to come to Heald.

THE HEALD MACHINE COMPANY

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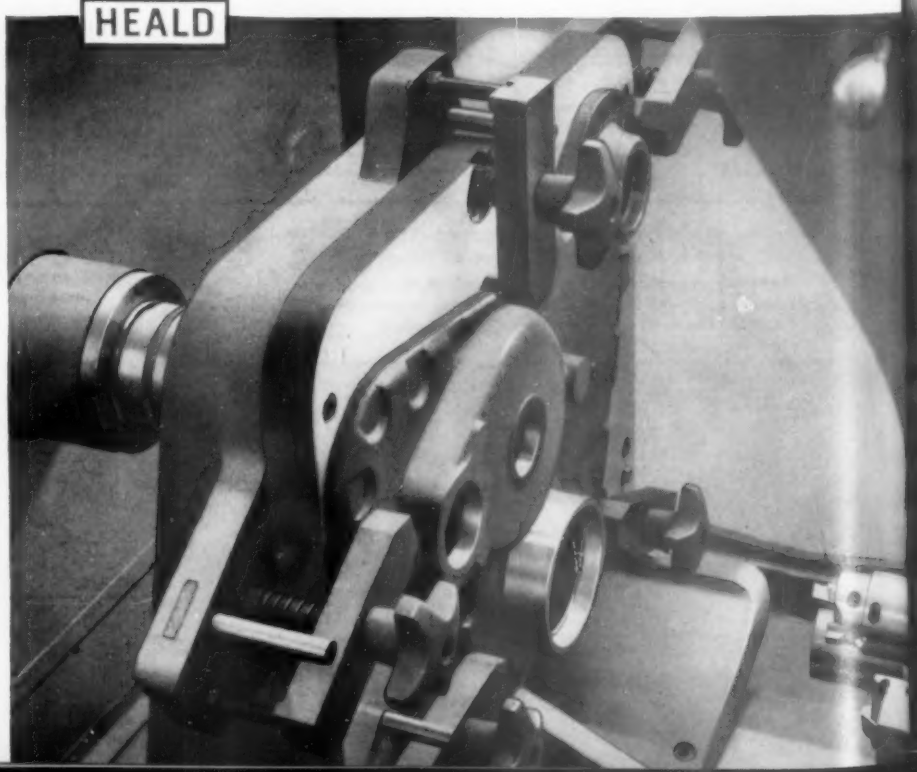
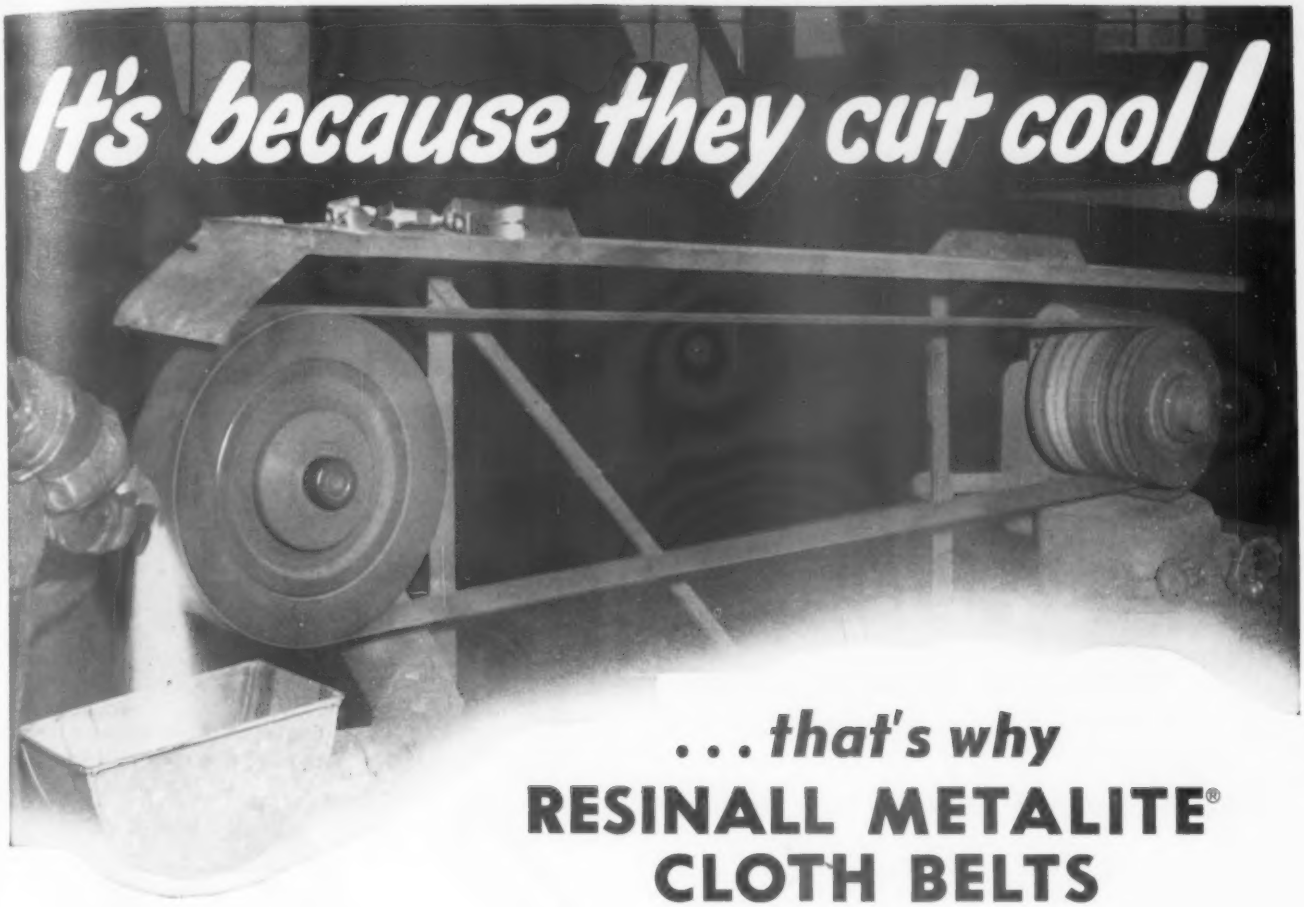
HEALD



Heald Model 322 Bore-Matic, showing multiple tooling and clamping fixture for borizing gear case covers in a single set-up.

It's because they cut cool!



. . . that's why RESINALL METALITE® CLOTH BELTS do more work per hour and more work per belt!

Write for this Bulletin
Get the full story of better belt finishing methods in a near-by BEHR-MANNING Demonstration Room. Ask for Bulletin. 'Proving Ground.'

Look at it this way — every spot on the belt is cooled by its trip to the idler and back again to the point of contact. It doesn't build up heat. You can shove *hard* against the wheel without burning the work. You remove stock *faster* with RESINALL METALITE Belts.

Another point — the resin bond. Grinding heat doesn't soften it. The abrasive grains are held rigidly in their original cutting position, like a lathe tool in a good tool holder. No laying away from the work, no rubbing, no excess, useless friction. It's all cutting — with RESINALL METALITE Belts.

Sustained cutting, too — not only because of the extreme hardness of the aluminum oxide grains, but because the heat-immune bond doesn't get tacky and pick up chips. This belt resists loading all through its long life.

All this is worth proving for your own profit. A BEHR-MANNING Field Engineer will gladly run a test on your work, either in your shop or our nearest Demonstration Room. Write us today. Address Dept. TE-2.

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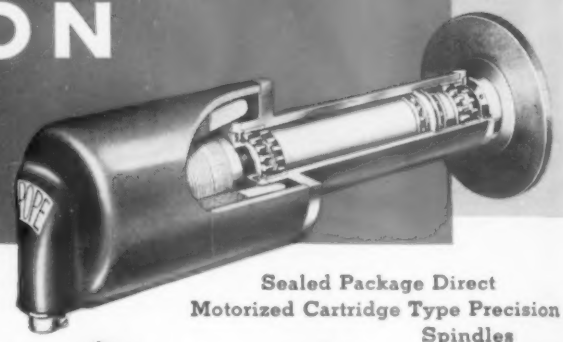
BEHR-MANNING • TROY, N. Y.

Use NORTON® *abrasives* sharpening stones

Specify POPE PRECISION SPINDLES



Sealed Package Direct Motorized Cartridge Type Precision Spindles

Here's Why:

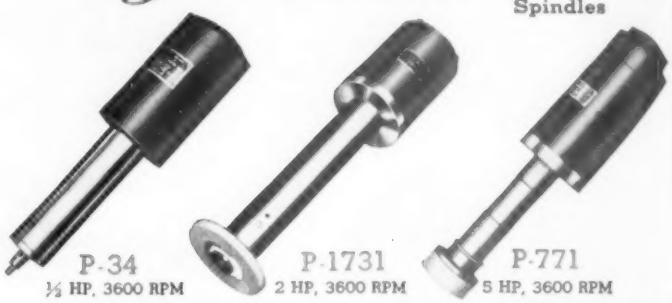
1. **POPE Spindles produce finer finishes.** They have the necessary massive construction and the radial and axial rigidity — *two* double-row, *super-precision*, cylindrical roller bearings and *two* separate ball thrust bearings.

2. **POPE Spindles increase production.** They have the power, the bearing capacity and the rigidity to carry a heavy cut. Rapid metal removal combined with superior final finish saves much operating time.

3. **POPE Spindles come in sizes to fit YOUR job.** They come in ½, 1, 2, 3, 5, 7½ and 10 HP and in 3600, 1800 or 1200 RPM to suit the work or the tool.

4. **POPE System of sealed-in lubrication** permits operation horizontally, vertically or at any angle — on boring mills, planers, millers, and other machine tools as well as on surface grinders.

5. **POPE Spindles require no maintenance costs** for lubrication or adjustments. This is just another bonus you get by specifying POPE Spindles.

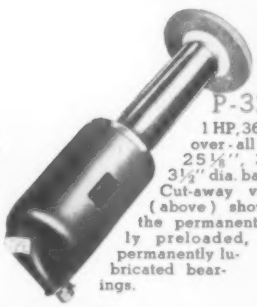


P-34 ½ HP, 3600 RPM

P-1731 2 HP, 3600 RPM

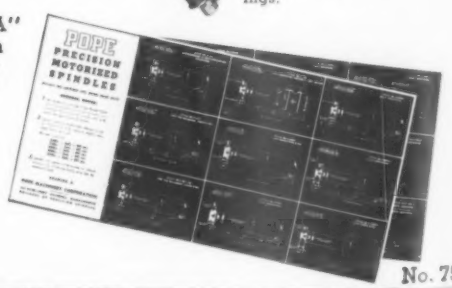
P-771 5 HP, 3600 RPM

P-772 10 HP, 3600 RPM (Shown in bracket). Mounting brackets are available for all spindles.



P-32T 1 HP, 3600 RPM, over-all length 25½", 3" or 3½" dia. barrel. Cut-away view (above) shows the permanently preloaded, permanently lubricated bearings.

Write for Drawings "A" and "B", showing a wide variety of styles and sizes of Round Frame Cartridge Type Pope Precision Motorized Spindles.



No. 75

POPE

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POPE MACHINERY CORPORATION

ESTABLISHED 1920

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THE TOOL ENGINEER
Publication of The American Society of Tool Engineers

The Tool Engineer

a Letter from the Editor...

As this is being written, the first letters from readers on the new *Tool Engineer* are beginning to arrive at the editor's office. Your response to the new *Tool Engineer* is, to say the least, highly encouraging. But even more than that, the comments and suggestions we've received have reflected a considerable amount of thought on the part of readers. And for this reason they will play an important part in future *Tool Engineer* improvements.

Some interesting comments we've received have reminded me again that, particularly among more recent subscribers, not all *Tool Engineer* readers may be familiar with our regular services and features. Since these services fulfill their purpose only if they are fully utilized, I'd like to outline some of them, and at the same time invite you to use them whenever they can help you.

For example The Reader Service card, further back in this issue, is designed to be torn out of the magazine and mailed without stamp or envelope. It provides three services: current manufacturers' literature, complete details on new equipment as reflected in the Tools of Today pages, and details of specific new products and services as offered by advertisers in *The Tool Engineer*.

Perhaps the value of these is not so obvious. Most of us, of course, are on the mailing lists of many manufacturers, and thus accumulate quite a file of tool engineering data. This method of building and maintaining a library has some fairly substantial drawbacks, however, and an important one is that it doesn't guarantee that our file on a particular line is complete. A serious problem if information is needed in a hurry!

Gilbert P. Muir

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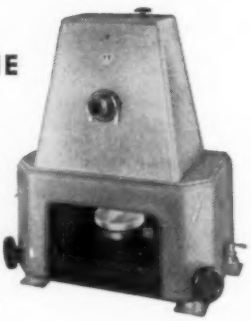
WITH THESE
BAUSCH & LOMB PRECISION INSTRUMENTS

STEREOSCOPIC WIDE FIELD MICROSCOPES

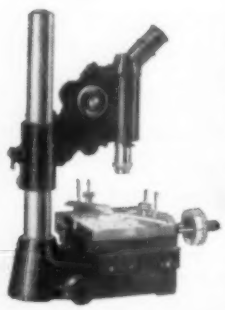
You save time and money by achieving greater speed and precision accuracy in small parts assembly operations . . . and in inspection of tools and finished parts . . . with this sturdy, dustproof instrument. *The finest optics ever produced for wide field work* assure you of accurate results. You get clear, sharp, three-dimensional images, and a *wider critcal focus than ever before.* The *unreversed* magnified image is more easily interpreted by the average user. These microscopes are extensively used in industry, with fifteen different models available for a wide range of applications. Catalog D-15.

New PARA-PLANE GAGES



Now you can have "laboratory" accuracy of 0.000001" in the determination of flatness and parallelism of reflecting surfaces . . . with production-line *simplicity* and *speed.* So simple that an unskilled operator can make measurements after a few minutes of instruction.

Two sizes of Para-Plane Gages are available. *Bulletin* D-224.



TOOLMAKERS' MICROSCOPE

Linear measurements to ±.0001", and, when fitted with a protractor eyepiece, angular measurements to ± 1 minute of arc, can be made with this sturdy microscope. Operation is extremely *simple* and *fast.* Opaque and transparent objects of any contour can be measured. *Catalog D-22.*

CONTOUR MEASURING PROJECTOR

No other projector can match its accuracy (angular measurements to ± 1 minute of arc with a protractor screen, and direct linear measurements to ±.0001" over a range of 4" x 6" with the cross slide stage.) Dimensions, angles, and profiles of production-run parts can be compared directly with a *traced outline* of the projected image of the master part, or with a large scale drawing superimposed on the screen. Inaccuracies are found quickly . . . simply.

WRITE for complete information on these five important optical aids designed to help you save time and money. You may be paying many times over their cost in lost time and rejects. Send your request to Bausch & Lomb Optical Company, 763-2 St. Paul Street, Rochester 2, New York.

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The Tool Engineer

Editorial

Retooling for Defense–Part III

WITHIN THE LAST few months many heavy changes have come about in the metalworking industry. In a number of lines, cuts in consumer production have ceased to be a topic of speculation; they have become a reality. In many other fields of civilian production the list of tight or officially curtailed materials is growing. It is a matter of time, of course, until defense production accounts for a steadily increasing share of our materials and industrial capacity.

But as we learned so emphatically during the last war, before bicycle factories can produce gun mounts they must be retooled for gun mounts. Machines must be adapted to the new production or moved out. New process and production lines must be established. Completely different tooling must be designed, manufactured and installed. New machines are designed or procured under priority. The "break-in" to full production must be watched, carefully steered, guarded. And all this, in all the bicycle plants across the country, takes many tool engineers.

ASTE's members, as individuals, chalked up quite a record during the last war. And as the war progressed and other tool engineers became aware of the size of the job and the comparatively few men who were available for the job, they got behind the Society as the one group which could help spread the answers to some of the problems.

During this emergency tool engineers were almost as hard to find as materials; in many cases they were much harder to find. As a result, the professional prestige of tool engineering had a healthy gain. And thousands of top tool engineers—ASTE members—fought hard to (1) hasten the recognition of tool engineering as a profession, and (2) preserve each gain as it was made.

Unfortunately industry, which benefitted tremendously from the rapid reconversions and retooling at war's end, has not kept pace with technology to the extent of recognizing the importance of tool engineering and the need for a continuous supply of well-trained tool engineers.

The result is that again tool engineers' services are in great demand, and great numbers of large companies which have not had adequate tool engineering staffs up to the present are hard pressed for competent tool engineers to supervise retooling for new programs.

We face, therefore, a twofold need: we must concentrate our fullest efforts on the heavy retooling requirements of the near future, and we must, through our Society, provide more competent tool engneers to take part in this national program. We can, with our widespread Society activities, aid immeasurably by disseminating data on tooling and production techniques to the many men who will need it.

H. L. Tiggers
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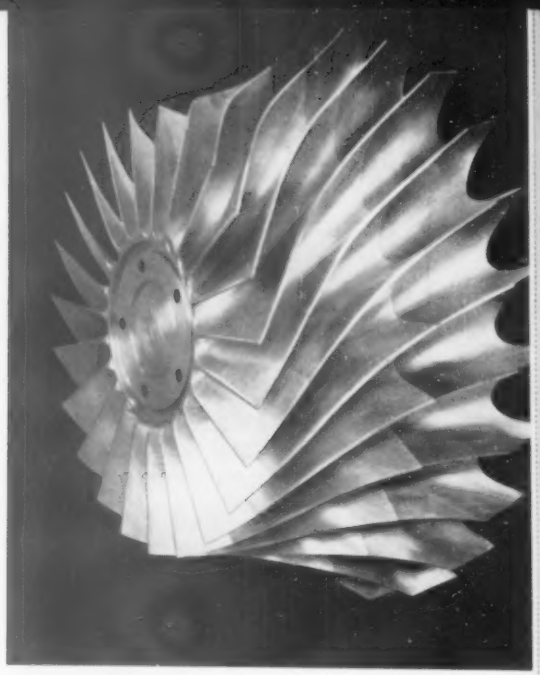
Tooling for Turbine Production

By Harold Woodhouse
CHIEF ENGINEER
POWER GENERATORS, LTD.



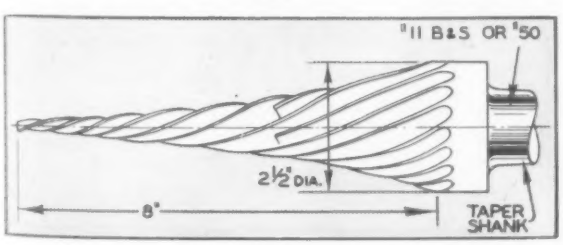
Vane contour and consequent cutting problems are apparent in this view of a typical Birmann impeller.

TOOLING FOR THE PRODUCTION of high speed mixed impellers and turbine wheels not only presents new problems in tooling, but introduces significant departures from what we generally consider conventional practice.

The cutter shown in Fig. 1 is typical of the specialized designs used in generating forms on these products; it is not used as a plug reamer but is fed sideways into the blank so that the cutting loads are always imposing bending stresses in the cutter. Further, as the cutter is fed into the blank—and spreading to include the whole length of the cutter—the blank twists against the cutter at a rate which increases as the cut gets deeper.

Conventional approach to setting and cutting speeds and feeds for this job would be somewhat as follows: since the cutter cannot run simultaneously at the recommended speeds for $\frac{3}{16}$ and for $2\frac{1}{2}$ in. diameters, the mean diameter of 1 $\frac{7}{32}$ in. would be the best basis for calculation, assuming eight teeth. Cautious planning would provide a light cut of about 0.002 in./tooth/rev/, at a minimum value of 800 fpm. Thus the cutter spindle speed would be 2500 rpm with a feed of 40 ipm.

Fig. 1. This cutter, typical of designs used to generate forms on impellers and turbine wheels, is fed sideways into blank.



Actually, years of experimentation has resulted in the conclusion that the optimum combination is a cutter spindle speed of 400 rpm with a maximum feed of 0.5 ipm, or roughly $\frac{1}{80}$ of what one would expect according to standard aluminum cutting practice.

The Birmann Impeller and Turbine Wheel

The photograph of a typical finished Birmann impeller shown above and the basic vane construction method will be clarified by a study of Fig. 2. Fig. 2 shows a conventional mechanical drawing cross-section of an impeller where $A'B'C'D'$ represents the contour outline of a basic form of vane which in practice would be narrowed across $B'C'$ to give a better air velocity distribution.

Since the vane passage is not flat and so does not actually lie in the plane of the paper as indicated by $A'B'C'D'$, the conventional drafting office procedure is to bring all points on the vane surface into the plane of the paper retaining, however, their exact diametrical values. It is this convention which produces the odd result that what is actually a straight line will appear in such a view as a curve. $A'B'$ and $C'D'$ could actually be straight lines as will be seen from a study of Figs. 2b and 2c, which show the manner in which the vanes are constructed. What is important to note is that with the forging blank turned to outside contour $A'B'$ in Fig. 2a, a straight edge, which will contact at every point, may be laid on contour $A'B'$ provided that

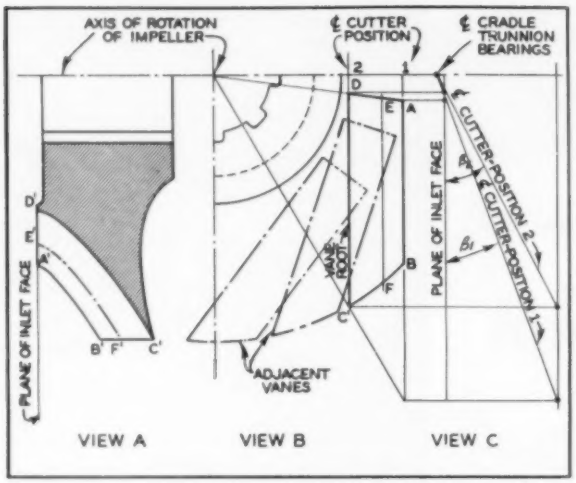


Fig. 2. This sketch shows cross-section of an impeller. Contour outline of a basic form of vane is indicated by A'B'C'D'.

it is placed in direction AB in Fig. 2b. For further layout convenience the impeller blank is shown as stationary and the cutter swinging through an angle in Figs. 2b and 2c whereas in an actual machine set-up the reverse would be true.

In Fig. 2b the cutter, which for the purpose of understanding the basic construction of the vane will be considered as of infinitely small diameter—a straight line—will contact the blank along line *AB* and will move, as it is fed into the blank, to position *CD*, which would be the root line of the vane.

With respect to the plane of the inlet face of the impeller—see Fig. 2c—the cutter will be seen to be at angle β_1 when it is at position *AB* and angle β_2 when it is at position *CD*.

The manner in which the blank is being twisted in moving from position *AB* to *CD*, (position (1) to position (2)), is seen by referring to Fig. 3, which is a diagrammatic sketch of the machining set-up.

Controlling Cradle Swing

The arrangement consists of an impeller blank mounted in a freely swinging cradle swing of which is controlled by gears or knife-edges. It should be noted that in elevation the axis of rotation of the cutter coincides with that of the centerline of the cradle trunnion bearings. Comparing this machining set-up diagram with the layout of the vane development—Fig. 2c—it will be seen that the centerline of the trunnion bearings is the point at which the cutter centerlines converge.

The function of the knife-edges or gears is to control the cradle swing so that, if:

β = instantaneous distance of the centerline of the cutter from the axis of rotation of impeller to be machined.

d = corresponding instantaneous angle of cutter with respect to inlet face of impeller

then $d \times \tan \beta =$ a constant value, say $= K$

then for other positions d_1 and β_1, d_2 and β_2, etc.,

$$d_1 \times \tan \beta_1 = d_2 \times \tan \beta_2 = K$$

From this formula it may be shown that the rate of twist or swing of the cradle will vary according to a curve as shown in Fig. 4, where it is seen to become very large as the cutter is fed into the blank, since angle β increases as the d dimension (Fig. 3) gets smaller.

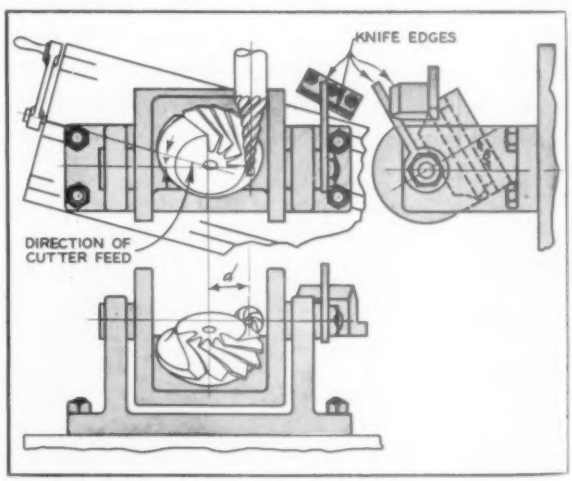
Fortunately the operational range of β is limited to 15 - 70 deg, but even so, there is a considerable difference in the rate at which the cradle is swinging when the angle approaches its maximum and the depth of cut is greatest, from what it was when the cut started with a 6 angle in the neighborhood of 15 deg.

The outstanding mechanical design feature of this form of impeller and turbine wheel vane is that while the basic construction is generated entirely by straight lines the resultant vane contours are quite curved as can be seen from the photograph of the impeller. In spite of the curved appearance of the vanes it is possible to lay a narrow straight edge along any vane provided that it is placed in the direction of a line such as *EF* (Fig. 2b). Keeping to the projectional convention previously mentioned, straight line *EF* would appear as the curved line *E'F'* in Fig. 2a.

The Milling Cutter

Because of the great variation in cutter diameter it is necessary to flute the cutter in several steps. Starting with 4 teeth at the small end, the number is increased to 8 and then to 16 at the large end. In an effort to preserve more core strength at the extreme tip, a two-tooth arrangement was tried. This was quite unsuccessful as the cutter tip lacked

Fig. 3. The setup for machining the impeller, showing how the blank is twisted from one position to another for cutting the vanes.



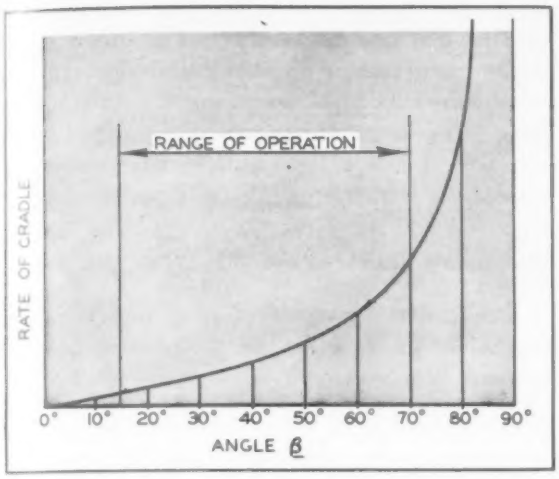


Fig. 4. Rate of cradle swing increases as cutter is fed into blank, since angle β increases as *d* dimension becomes less.

the self-centering quality which is provided by the added teeth in a four-tooth tip. The effect of the two teeth was excessive chattering, which would have resulted in cutter failure if the cut had continued. Several settings are required in the fluting milling or grinding operation to keep the spiral angle to the desired value of 20 - 30 deg.

Much experimentation has led to the adoption of this spiral angle coupled with a left-hand spiral and a right-hand cut as giving the cleanest cutting and best chip-removal combination.

The cutter tooth profile follows standard practice, the only difference between those for aluminum impellers and steel turbine wheels being the undercut on the tooth face for aluminum (see Fig. 5).

Cutter Evolution

Following the experience obtained in previous years in the evolution of tapered cutters for commercial turbine nozzles, the early cutters made for Birmann vane milling were made from an oil-hardening, non-deforming steel hardened to Rockwell C 55-58 in preference to high speed steel. While this practice necessitated more frequent resharpenings, it undoubtedly saved many headaches caused by broken cutters in the evolutionary phase where rarely more than three impellers or turbine wheels were made to one design. Cutters in this period were quite expensive, as the impeller and wheel vanes were machined completely in one setup, whereas later the blanks of the impellers were split into three separate sections which permitted the use of smaller and cheaper cutters. The chief concern has been, however, that in the process of breaking, the cutter may ruin a vane. When a vane is ruined the entire forging is ruined since no patchwork is permissible or feasible. Fortunately, in the early evolutionary phases, using the oil-hardening steel and a manual feed applied by an experienced toolmaker who knew instinctively when the cutter was being overloaded, there were few broken cutters.

Later, for production, high speed steel hardened to Rockwell C 61-63, was adopted. It is obvious that the heat treater has a problem on his hands to avoid melting the $\frac{3}{16}$ in. diameter cutter tip while bringing the $2\frac{1}{2}$ - $3\frac{1}{2}$ in. diameter shank end up to temperature. Many high speed steel cutters have been lost in the heat treatment process because the tips melted away. To avoid this the heat treater would sometimes keep the bath temperature too low, with the result that some high speed steel cutters were delivered which were found to be only Rockwell C 54-55 and consequently were rejected by receiving inspection.

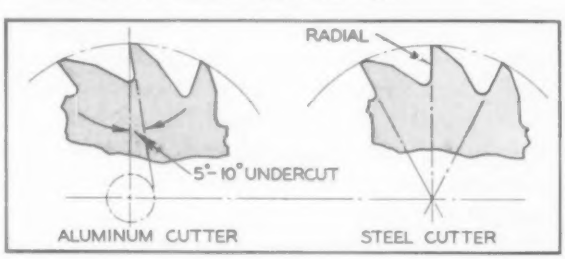
Always the critical area with this form of cutter is the section approximately $1\frac{1}{2}$ - 2 in. from the small end. The bending stresses set up here by the resultant of the normal cutting load and the twisting load combine to exceed the tensile strength of the material of the cutter, so that whenever dulling of the cutting edge occurs it is quickly followed by a broken cutter.

Cutter Switch Necessary

Splitting the impeller into three sections as was done early in the development, enabled the critical inlet section to be machined separately so that the vulnerable cutter tip section could be made as a separate cutter. While this step saved the loss of heavy, expensive cutters which would have to be scrapped just because the tips were broken, it did not change the basic cutter problem.

Fig. 6 shows how a separate tip milling cutter is fed into the blank of an inlet section as viewed from the top, or inlet face, of the impeller. In order to produce the requisite amount of radial taper in the vanes to resist the enormous centrifugal forces which will be produced at operational speeds of 20,000 - 25,000 rpm, it is necessary to pull the cutter back as it is fed into the work so that a smaller cutter diameter becomes active, thereby leaving more material toward the vane root. If

Fig. 5. Cutter tooth for work on aluminum carries a 5-10 deg undercut, chief design difference between Al and steel cutting.



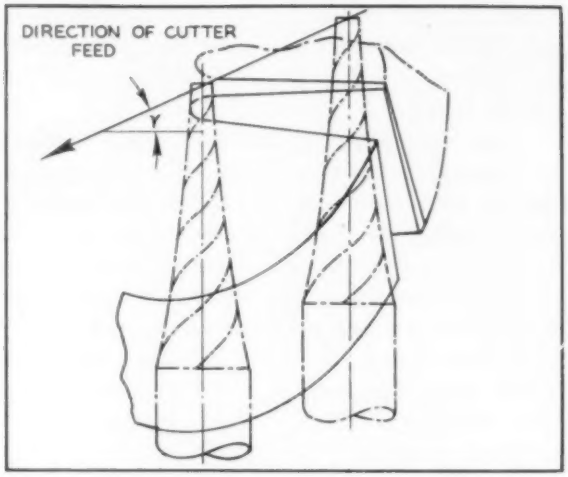


Fig. 6. To enable impeller to withstand high centrifugal forces, more material is left at vane root. This necessitates change in cutters, as shown.

angle $\gamma°$ (see Fig. 3 and 6) is the direction of the feed with respect to the normal to the cutter axis, the amount the cutter is pulled back is the feed in inches multiplied by sine $\gamma°$. At the bottom of the cut, which will be the root of the vane, the cut will be close to the extreme tip of the cutter.

The critical condition, as far as the cutters are concerned with this design, is always at the vane root where the cutter is active to its extreme tip. Because a maximum number of vanes is required for high operating efficiency—depending on size but the prime number 23 is in common use—the cutter tip is always made as small as is considered feasible. Currently this is in the neighborhood of $\frac{5}{32}$ in. diameter since, although it may not actually be cutting below $\frac{3}{16}$ in. diameter, a slight overrun is necessary and some axial adjustment is required for a finish cut and to compensate for cutter deflections.

Aluminum vs. Steel

It might appear unconventional that the aluminum impellers have always been much more difficult to mill than the turbine wheels made from high-temperature-resistant austenitic steel alloys with their tungsten, molybdenum, vanadium and manganese ingredients and their work hardening characteristics.

The turbine wheels were originally made from A.T.V.#3 and later from N-155, 19-9DL and others. The composition of A.T.V.#3 was: tungsten, 3.24 percent; chromium, 15.30 percent; nickel, 27.30 percent; and manganese, 1.46 percent.

Even with this imposing array of tough alloys and only slightly more favorable conditions of vane contour and angles, the turbine wheels have always cut far more easily than the aluminum impellers. Some early trouble was experienced with dummies used for checking the accuracy of original machining set-ups of turbine wheels. Machined from boiler plate to the same blank contour as the actual wheels, these dummies caused cutters to break and vanes tear out. When a free-cutting material was substituted no further trouble was experienced.

Machining Factors

The reasons for the machining rate falling so far below standard for aluminum may be summarized as follows:

1. Wide variation of cutting conditions along cutter due to change in diameter from $\frac{3}{16}$ to $2\frac{1}{2}$ in.
2. Cutter becomes active at extreme tip; its worst condition of bending stress occurs when the area of cut is greatest and the rate of twist or swing is at a maximum.
3. Tip end of cutter is smaller than is dictated by conservative practice in order to permit a maximum number of vanes to give a high operating efficiency.
4. Slenderness of cutter precludes use of outboard steady bearing.
5. Swinging motion required of blank prevents any clamping down to solid base. In this connection it might be asked why not make a design of machine tool which would have the necessary rigidity? It is quite true that this is no impossibility but it would necessitate a one-purpose machine which in itself can be justified only for a thoroughly frozen design for which massive production orders are available.

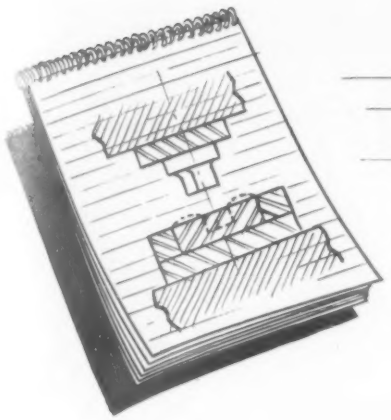
Vane Generation

To generate the Birmann vanes a specialized machine tool is available, produced by the Wiedemann Machine Co. Operation is automatic on the designs —one for aluminum and one for steel impellers.

Regulation of the cradle swing in vane generating machines is accomplished by an arm, which in turn is governed by a variable gear train.

An important design difference is that the relative motions of the larger machine (for steel vanes) are turned 90 deg in space with respect to the smaller unit. For this reason the smaller design has its moving arm swinging in a vertical plane, as compared with the vertical travel of the larger unit. This arrangement permits the machining of large diameter turbine wheels without resorting to use of an excessively heavy swinging cradle.

Those who might wish to study the basic vane mathematics and construction more closely will find U. S. Patent No. 1,959,703 of considerable assistance.



A notebook on die design....

By John S. Brozek
SARGENT AND COMPANY

Part I

Guide List for Proper Die Design

1. Important Press Dimensions To Be Considered
   A. Shut height (adjustment up, ram at bottom of stroke)
   B. Roll feed height (distance from top of bolster to center of roll feed)
   C. Shank diameter and length
   D. Hole in press bed (width and length)
   E. Stroke length (measured by distance spotted on crankshaft end)
   F. Adjustment of slide (distance of Pitman screw travel)
   G. Does gate open up into ways?
   H. If "G" is yes, check the opening between the ways
   I. Which way should the die feed?
   J. Rated tonnage of press (measured at main bearings)
   K. Additional holes for clamping punch shoe to gate (hole size)
   L. Bolt hole centers in press bolster
   M. Bolster plate opening
   N. Bolster plate thickness
   O. Throat opening (distance from center line of shank opening to press frame)
   P. Position of bolster plate in relation to center line of shank opening

Calculating Press Tonnage Required For Blanking Pressure

FORMULA

T = Tons of cutting pressure required
L = Total length of cutting edge in inches
Note:—If blank contains round holes, or other openings which are to be cut simultaneously with blanking, the total length of these cuts should be added to the perimeter of the blank.
MT = Material thickness in inches
S = Ultimate shearing strength of material in tons per square inch
SF = 25 percent safety factor in tons
P = Press capacity

SOLUTION

$T = L \times MT \times S$
$T = 10 \times .050 \times 22.5$
$T = 11.25$
SF = 25 percent X T
$SF = .25 \times 11.25$
SF = 2.81 Tons
$P = T + SF$
$P = 11.25 + 2.81$
P = 14.06 Tons
P = 15 Ton press

Note:—For shearing cut where material does not exceed ¼ in. thickness, use two-thirds of tonnage in the table.
For shearing cut which exceeds ¼ in. thickness, use three-fourths of table tonnage.

End Wheel Presses

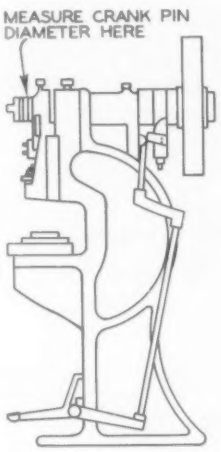
"End wheel presses" have what is known as the overhang crankpin whose diameter is used in computing ultimate shearing strength of the crankpin area.

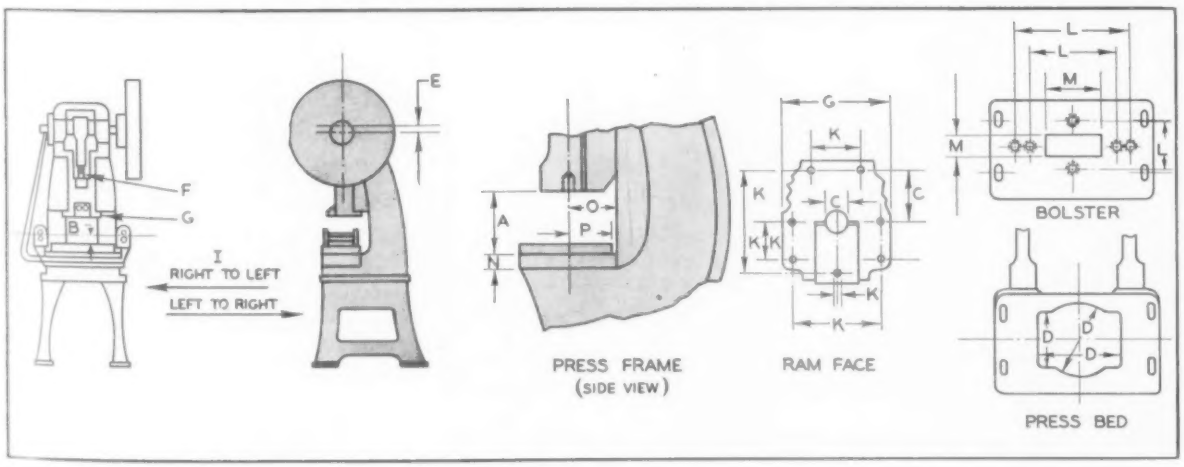
FORMULA

T = Tons, ultimate shearing strength of crankpin area
D = Diameter of crankpin
C = 2½ ton constant

SOLUTION

$T = D^2 \times C$
$T = 2^2 \times 2\frac{1}{2}$
$T = 4 \times 2\frac{1}{2}$
T = 10





Calculating Press Capacities When They Are An Unknown Factor

Rating of press ton capacity is determined by the size of the crankshaft in both single and double crank presses.

"Open frame presses" having up to 6 in. diam crankshafts measured at the main bearings, both being equal diameter, shall be as follows:

FORMULA

T = Tons, ultimate capacity at bottom of crank stroke

D = Diameter of crankshaft

C = 3½ ton constant

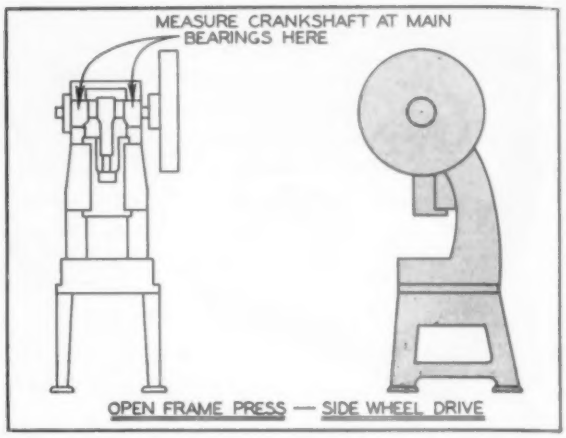
SOLUTION

$T = D^2 \times C$

$T = 3^2 \times 3\frac{1}{2}$

$T = 9 \times 3\frac{1}{2}$

$T = 31\frac{1}{2}$



ULTIMATE SHEARING STRENGTH OF MATERIALS USING FLAT-FACED PUNCH AND DIE

Material	Tons Per Sq. In.
Aluminum cast	6
soft sheet	7½
half-hard sheet	9½
hard sheet	12½
Asbestos millboard	2
Brass, cast	18
soft sheet	15
half-hard sheet	17½
hard sheet	20
Bronze, gun metal	16
phosphor	20
Copper, cast	12½
rolled	14
Cupronickel	20
Duralumin, soft sheet	15
treated	17½
treated and cold rolled	20
Fiber, hard	12
Iron, cast	12½
2 percent nickel	25
wrought	20
Lead	2
Leather, chrome	3½
oak	3½
rawhide	6½
Monel metal, cast	30
rolled sheet	32½
Nickel silver, half-hard sheet	16
Paper, using hollow die	1½
using flat punch	4¼
bristol, flat punch	2½
strawboard, flat punch	1¾
Silver	15
Steel casting	30
boiler plate	30
angle iron	30
cold-drawn rod	29
drill rod, not tempered	40
nickel about 3¼ percent	41
nickel about 5 percent	42½
silicon	32½
stainless	35
0.10 carbon (soft)	22½
0.25 carbon (mild)	25
0.50 carbon	35
0.75 carbon	40
1.00 carbon	42½
1.20 carbon not tempered	47
1.20 carbon tempered	95
hot	1/6 to 1/4 strength of cold
Tin, cast	3
rolled sheet	2½
sheet steel coated with tin	25
Zinc, sand cast	7
die cast	8
rolled sheet	9
hard rolled	10

RATED CAPACITIES, OR BOTTOM-SLIDE PRESSURE, OF CRANKSHAFT PRESSES

Rated Capacity	Diameter of: Crankshaft[1]	Diameter of: Overhanging Pin[2]
TONS	INCHES	INCHES
3	1	1⅛
4	1⅛	....
4½	1¼	1½
6	1⅜	....
7½	1½	1¾
9	1⅝	....
10½	1¾	2
12	1⅞	....
14	2	2¼
16	2⅛	....
18	2¼	2½
20	2⅜	....
22	2½	2¾
24	2⅝	....
26½	2¾	3
28	2⅞	....
31½	3	....
37	3¼	3½

Rated Capacity	Diameter of: Crankshaft[1]	Diameter of: Tierods[3]	Diameter of: Overhanging Pin[2]
TONS	INCHES	INCHES	INCHES
43	3½	2	4
50	3¾	2	4½
56	4	2¼	....
65	4¼	2¼	....
71	4½	2½	5
80	4¾	2½	....
86	5	2¾	5½
106	5½	3	6
126	6	3¼	7
150	6½	3½	....
180	7	3¾	....
215	7½	4	....
255	8	4½	....
300	8½	4¾	....
345	9	5	....
400	9½	5½	....
450	10	5¾	....

[1]Diameter of crankshaft in single- or double-crank, open-frame presses.
[2]Diameter of overhanging pin in end-wheel presses.
[3]Diameter of tierods in one- or two-point suspension, closed-frame presses.

Pressure capacity figures are given for all single-action presses and for the inner, or drawing slide, of double-action presses. Crankshaft diameters are measured at main bearings. These capacities are based on standards adopted by the Committee on Metalworking Machinery of the Technical Committee on Standard Commodity Classification, Division of Statistical Standards, Bureau of the Budget, Washington.

Surface Finish and Manufacturing Economy

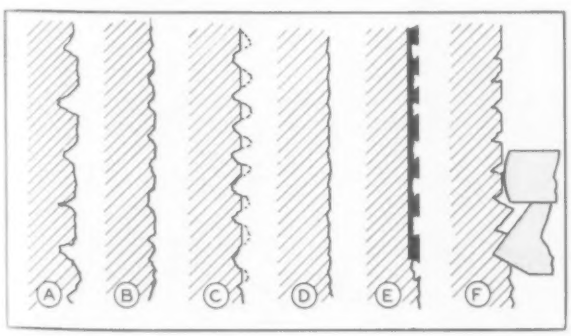
By Andrew E. Rylander

WHILE SURFACE FINISH may be considered from various viewpoints, including appearance for sales appeal and resistance to the elements, it will be discussed here mainly in terms of dimensional accuracy and—as a natural corollary—resistance to wear between mating parts, the whole in turn integrated with end use and manufacturing economy.

With regard to mating parts, the degree of surface finish varies with application. Parts which are merely joined face to face, such as cylinder heads to cylinder blocks and assuming intervening gaskets, require but comparatively rough or "as machined" surfaces. There is no wear between such parts, and the comparatively rough surfaces aid in sealing the joint.

Where, however, there is linear or rotary motion, as in the case of piston travel in cylinders, the movement of slides in bed ways, or rotation of shafts in bearings, then a combination of dimensional accuracy and high surface finish not only has a definite bearing on wear but on cost of manufacture.

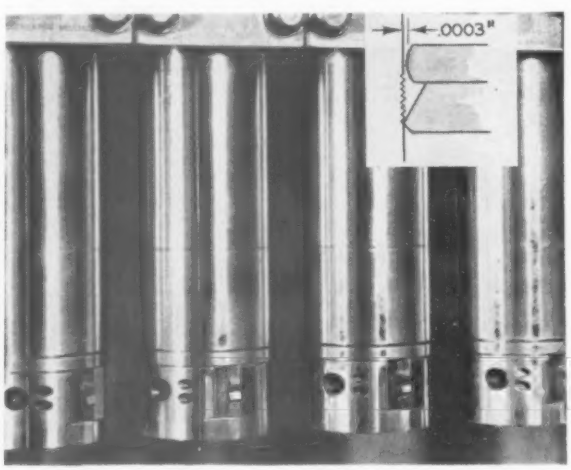
Some types of finishes produced by various methods. At *A* is an as-machined surface; *B* is ground. *C* is a honed or superfinished finish. At *D* is a lapped surface; *E* shows a porous-chrome-plated finish; and *F* is the finish of a recently-developed boring method.

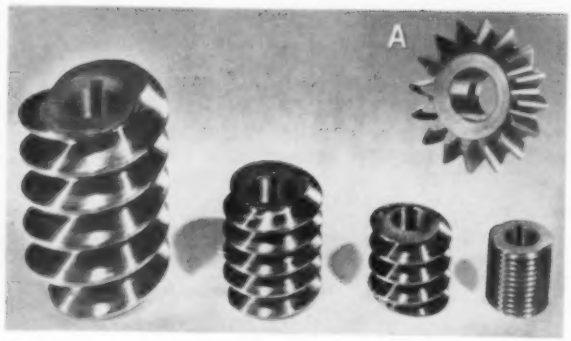


Classification of Finishes

Broadly put, finished surfaces may be subclassified as follows: machined, which implies turning, boring, planing, shaping, milling, reaming and even grinding to acceptable dimensional and quality standards; ground, implying a relatively finer surface finish and close dimensional accuracy; diamond bored or turned, used as an alternative to grinding and mainly applied to the final sizing and finishing of non-ferrous parts, notably the boring of piston pin holes in automotive pistons.

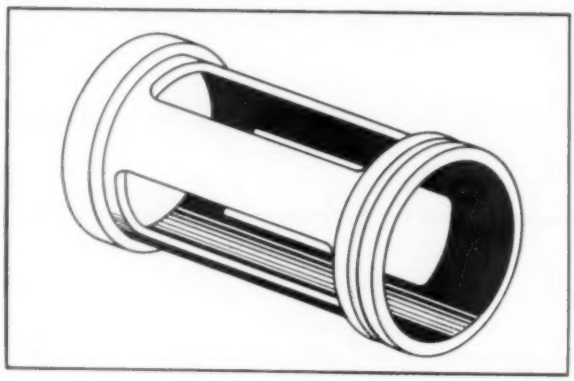
A section of a multi-spindle boring machine for boring automobile cylinders. Two tool bits are set in tandem, with follower tool removing crest left by lead tool.





Top left: **These worm gears with keyways are honed at the rate of 150 per hour. Material is SAE 1315, hardness RC 62-70, and ID tolerance is 0.0005 in. Wringer gears shown in inset are honed by a blind operator to 0.001 in. tolerance at a rate of 183/hr.**

Bottom left: **Truing the stones after each pass made honing practical on this slotted part. Formerly, lapping took 30 minutes; honing cut this to less than 2½ min. per part.**



Then, in overlapping order: honed, "Bearingized" and lapped, any or all of which may be applied to final sizing and finishing of internal and external diameters; and superfinish, the latter usually applied to the final surface finishing rather than actual sizing of such items as crankshaft journals and pins among a diversity.

To these methods of surface finishing may be added scraping which, however, is a specialty confined to a minority of highly skilled craftsmen. It is not essentially a mass production "tool," and except for surface plates and certain classes of uitra-precision machine tools, is being superseded by grinding of surface-hardened slides and bed ways.

Qualities Overlap

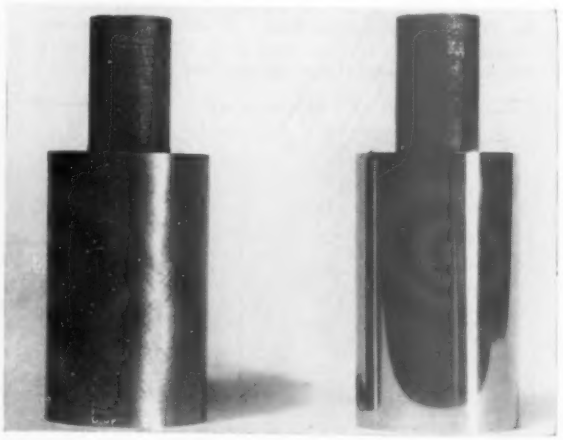
A comparison of the several commonly used methods of surface finishing may serve to more clearly define their applications and limitations. For instance, it may be inferred from the foregoing that grinding produces a finish inferior to honing; however, this would hold true only if both processes were carried to the ultimate of refinement. Actually, all of the processes under discussion overlap in ascending order of refinement.

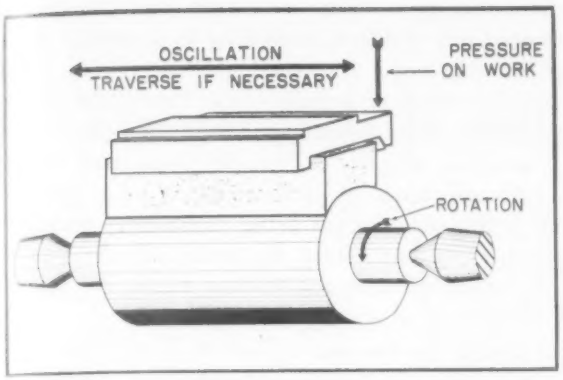
For example, machined surfaces range from about 30 to 300 micro inches; ground from 10 or finer to 60; honed from a possible 1 to 120; bearingized from about 4 to 8 and over; superfinished from about 1 to 15; and lapped from practically zero to 15 and coarser. The degree of surface finish imparted by any of the above-mentioned methods is largely dependent on the nature of the material being processed, its hardness and the surface quality of previous machining.

What with improvements in grinding wheels, increased rigidity of grinding machines and radically increased spindle speeds, it is now possible to achieve a surface finish, by grinding, that in superficial appearance compares favorably with both honing and superfinish. Parts ground under ultra-modern conditions have retained an untarnished, mirror-like surface after several years of exposure to atmosphere and recurrent handling.

At left is a cross-hatch surface produced by honing, desirable for automotive cylinder bores. Coarse surface provides for retention of lubricant. At right are examples of super-finished surfaces.

Cylinder at left has a comparatively coarse finish (about 12-14 mu), with cross-hatched finish, while cylinder at right represents ultimate in quality produced by this method.





Diagrammatic sketch of superfinish principle applied to cylindrical work. Besides rotation of work, there is endwise oscillation.

Aside from the relative qualities of the surface finish imparted, the main difference between grinding and honing is that where the former involves a combination of high surface speed and slow feed, normally producing microscopic threads, honing operates on a principle of comparatively slow surface speed—about 100 to 225 sfpm—and a fast, reciprocating feed. The result is a zigzagging, cross-hatch surface pattern from which minute projections have been levelled off. The surface so produced may be bright or matted, depending on use-purpose.

Prior to the advent of honing, it was customary to grind automobile cylinder bores and also to grind the pistons. Despite the most painstaking care, however, the grinding left minute, thread-like ridges which, if they did not immediately cause scoring or galling, soon wore off and resulted in premature piston slap. Honing, which has considerably reduced the breaking in period for new automobiles, produces a surface which is free of protuberances and permits pistons to be installed at normal operating clearances. In addition, where it was customary to impart a highly polished surface in the earlier days of honing, cylinder bores are now finished with a comparatively rough, matted surface—say about 20 to 25 micro inches—for improving lubrication. A high surface finish does not necessarily imply maximum operating efficiency.

Honing and superfinish have this in common, that both employ abrasive stones to impart the desired finish; also, both operate at comparatively low surface speeds, thereby generating a minimum of heat as compared to grinding. Consequently, there is no surface checking. As compared to the continuous rotary motion and fast reciprocating feed of honing, however, superfinish operates on a principle or rotation and reciprocation to which is added a rapid, short-stroke oscillation. That is, for cylindrical parts; flat work may require only reciprocation and oscillation.

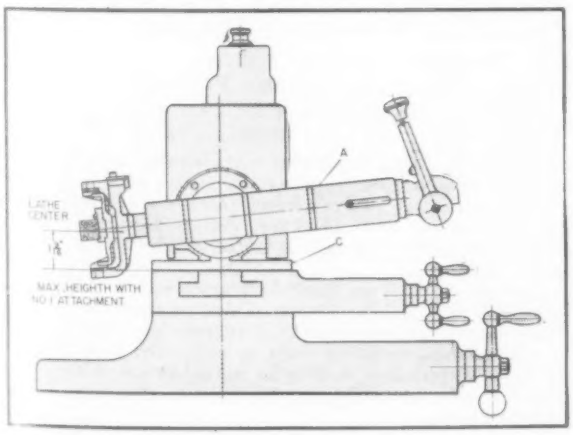
Surface speed is commonly held to 50-60 sfm—seldom exceeding 60—while the oscillation is about $\frac{3}{16}$ in. at some 400 cycles per minute. The main difference between the two methods is that honing is at once a dimension generating and finishing process, whereas superfinish is essentially a surface finish. Stock removal averages 0.0001 to 0.0002 in.

Lapping for Final Sizing

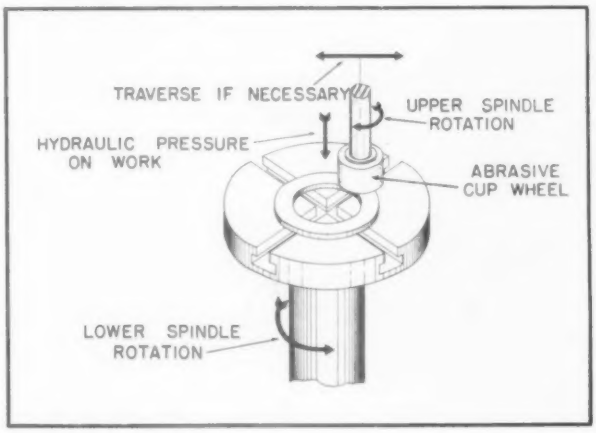
Lapping, as contrasted to honing and superfinish, involves loose abrasives—emery, carborundum or diamond powder—which are charged into the lap, the latter usually of a softer composition, such as lead, copper, brass or cast iron, than the workpiece being lapped. In common with grinding, lapping may carry loose particles of abrasives which, except in the case of hard materials, may be imbedded in the surface of the work or, if not washed out, may remain in crevices to cause later trouble.

For that reason, lapping is not generally recommended for soft materials; it is, however, ideal for the final dimensional sizing and surface finishing of such parts as gages and instruments which must be held to ultra-precision limits of tolerance. Here, as in honing, superficial appearance is of secondary

Below is a standard lathe attachment for superfinishing, shown with a flat-surfaced stone, although stone usually is contoured to suit.



Typical setup for flat finishing. Stone is a bonded cup wheel, which rotates, as does the workhead mounting the workpiece.



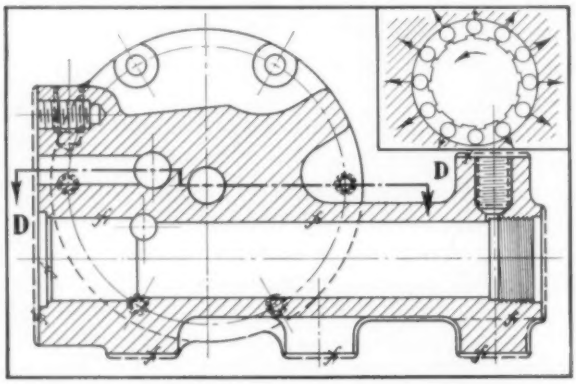
importance to dimensional accuracy, a matted finish being just as accurate as a high gloss finish. Needless to say, however, the lapped surface can also approach the ultimate in gloss finish.

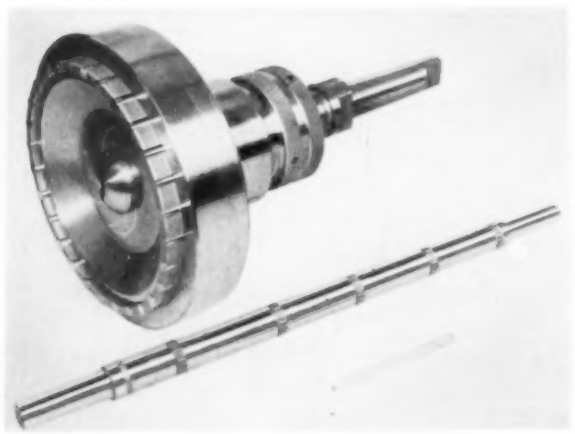
While laps can be inexpensively made for dimensional sizing of special or individual parts, the process is also a mass production tool in every sense of the word. One has a wide choice of commercially available internal and external laps, adjustable for wear, while centerless lapping machines are also available for automatic duplication of cylindrical parts on a mass production basis.

Bearing-izing

Bearing-izing, which is also a mass production method for sizing and surfacing, employs rollers to condense and displace the metal. In effect, it can be likened to swaging in reverse, the rollers riding up on cams to impart hammer-like blows against the material. The method is extremely fast and, on mass production runs, tolerances may be held plus or minus 0.0001 in. consistently.

The hammering, at a rate of about 200,000 blows a minute, has a peening effect which, in turn, imparts a superficial hardness to the material being sized; however, the actual amount of displacement is limited by the ability of the material to flow with the hammering. Displacement varies from a few tenths to several thousandths of an inch; however, 0.0005 in. may be set as an average if previous machining is reasonably smooth.





While its applications are comparatively limited, one may not overlook burnishing as a method for surface finishing. A distant relative if not the remote ancestor of bearing-izing, burnishing also operates by compressing and displacing material. An essential requisite is that the burnishing tool be extremely hard, to prevent picking up material and galling the surface being processed. Among typical applications may be mentioned the final sizing of phosphor bronze bushing which, ordinarily, are difficult to size by reaming.

Although the diamond represents the ultimate in cutting tools for precision boring and turning, because of its extreme hardness, and is therefore widely used for ultra-precision work, developments in carbides are gradually forcing its disuse in the automotive industry except for the more delicate finishing operations. In connection with such finishing operations as final sizing of automotive piston O.D.'s and piston pin bores, therefore, the term diamond boring is latterly somewhat of a misnomer, most of this work now being done with carbide tools.

Carbide Boring

While the carbide tools are by far less expensive, both in first cost and upkeep, surface quality suffers somewhat in comparison with diamond processing, the finish imparted ranging from about 13 to 15 micro inches for boring of piston pin holes. While somewhat coarser than one would normally expect from diamonds, this finish is nevertheless well within the limits required for normal wear life of the modern automotive engine.

In this connection, it is reported that a British manufacturer has upped the finish imparted by carbide tools until it compares favorably with diamond turning and boring. This is done by honing and burnishing the carbide bits after grinding, which not only produces a superior finish but also greatly extends normal tool life.

Illustration Credits

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Top left: **Cross-section of a hydraulic brake cylinder, Bearingized to a surface finish of 4 to 6 mu at a rate of 100 per hour. As indicated in inset, Bearingizing involves rapid hammer blows (200,000 per min.) imparted by cams in the arbor.**

Bottom left: **Two typical Bearingizers; the large one at top is an external design used for components of an automatic transmission. Tool is expandable, entering hole in collapsed position and expanding to size as machine spindle advances. Lower tool is used for internal sizing and finishing.**

Nomograph on Bend Allowances

By Leonard M. Majeske

UNIVERSITY OF DETROIT

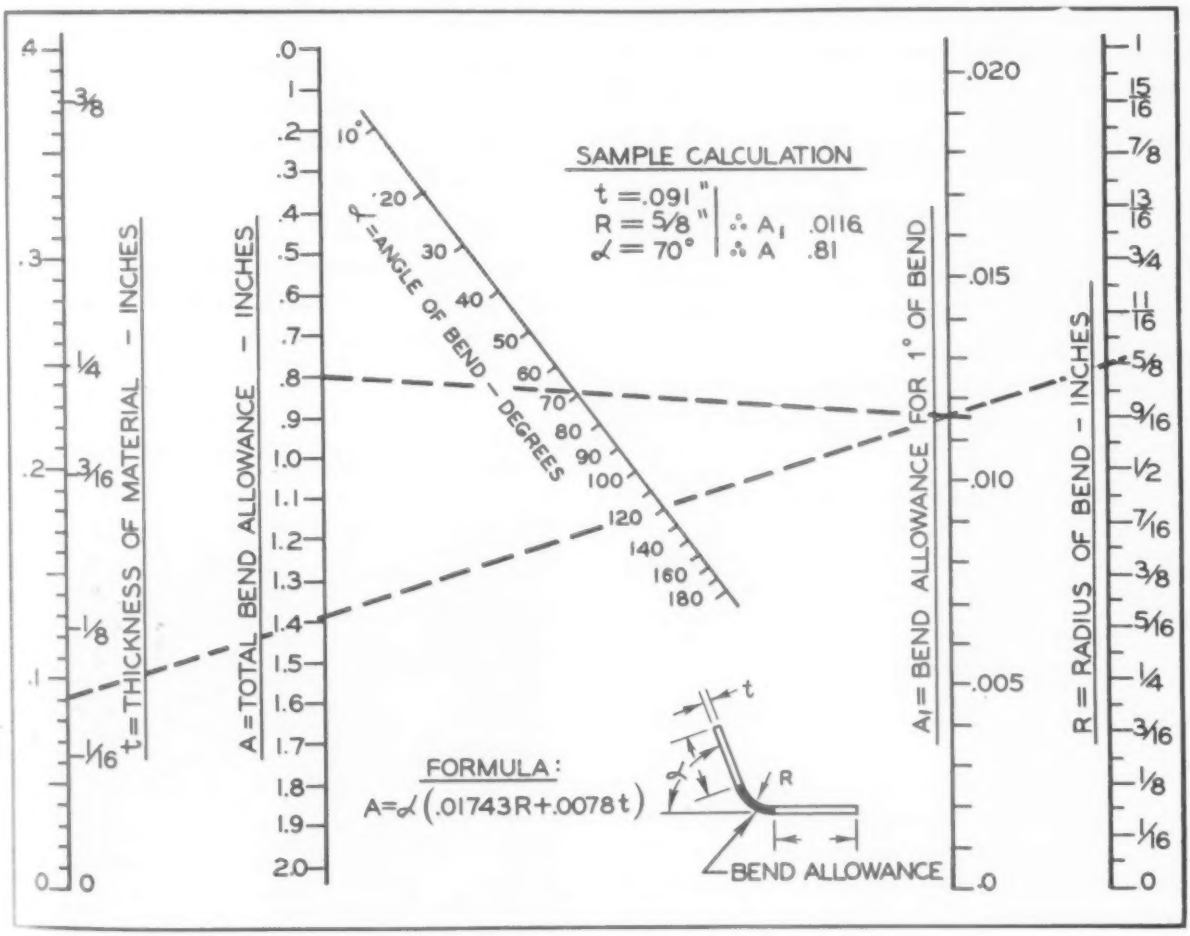
THE NOMOGRAPH shown below may be used to determine the amount of material in a bend when it is desired to calculate the developed length of a formed sheetmetal part.

Utilizing t, thickness of the material; A, the angle of bend in deg; and R, the radius of bend in in., the bend allowance in deg and inches is developed.

To use the nomograph, draw a line from the scale on the extreme left (thickness of material) to the scale on the extreme right (radius of bend). The intersection of this line with the scale A_1 determines the bend allowance for one deg of bend.

From this value, draw a line to connect on the middle scale, the angle of bend, then project the line to the A scale and read off the bend allowance.

The A_1 scale gives a precise value, and if it is desired to determine precisely the total bend allowance, this value may be multiplied manually by the number of deg or bend to determine the total bend allowance.


t = THICKNESS OF MATERIAL - INCHES
A = TOTAL BEND ALLOWANCE - INCHES
α = ANGLE OF BEND - DEGREES
A1 = BEND ALLOWANCE FOR 1° OF BEND
R = RADIUS OF BEND - INCHES
SAMPLE CALCULATION
t = .091"
R = 5/8"
α = 70°
∴ A1 .0116
∴ A .81
FORMULA:
A = α (.01743R + .0078t)
BEND ALLOWANCE

Engineering Aspects of

Tool and Die Welding

By Arthur R. Butler
PRESIDENT
WELDING EQUIPMENT AND SUPPLY COMPANY

Part III

BECAUSE OF THE DIVERSIFIED composition of tool steels, their heat-treatment is a vast and complex subject. It has been determined that in practical tool and die welding, it is not necessary that the electrode used be the exact match to the analysis of the tool steel being welded. However, in most cases, the welding electrode should match the heat-treatment, in its classification, as closely as possible.

All heating and cooling operations really constitute heat-treatment, but in a restricted sense heat-treatment means the hardening and tempering of the steel. Variations in heat as well as cooling cause structural changes in tool steel. Transformations are made in the grain structure of the metal which in turn changes the characteristics of the steel. Therefore, a study of the elementary phases of heat-treating will aid the welding operator.

Repairing Tool Steel Units
(Recommended Welding Sequence)

There are six main steps in the correct welding sequence for repairing existing die units:

1. Determining the type of steel to be welded.
2. Selecting the proper electrode.
3. Preparing the surface to be welded.
4. Preheating.
5. Applying the electrode.
6. Post heating (or tempering) the weld deposition or unit itself.

An explanation of each step in the above welding sequence follows.

1. Determine the Type of Tool Steel To Be Welded

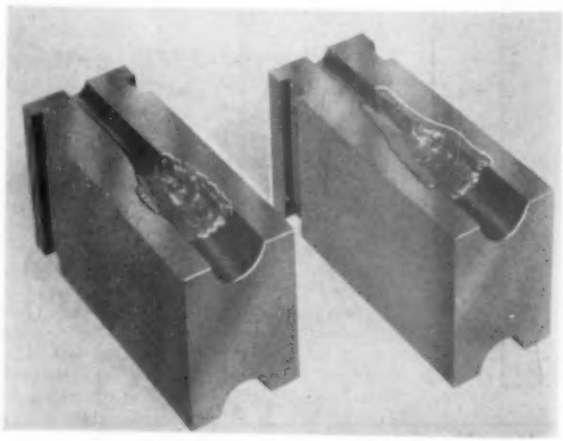
Determination of the type of tool steel to be welded will indicate the heat-treatment involved and will govern the subsequent handling of the unit in the welding sequence.

2. Select the Proper Electrode

In making partial repairs of cutting edges or working surfaces select the electrode that will match, as closely as possible, the heat-treatment of the metal to be welded.

In making full repairs to cutting edges or working surfaces choose the electrode with characteristics best suited for the type of work the unit will

A set of hot work dies which were repaired using hot work electrodes.



have to do, taking into consideration any factors involving heat, abrasion, shock, thickness of metal to be cut or formed.

For repairing forging dies, or facing cast structures, or carbon steel drawing for forming dies, select alloy welding electrodes recommended for this purpose.

The size of the electrode to be used depends on the width and depth of the damaged area. In general, a 3/32 in. electrode will repair a damaged area 3/32 in. wide and 3/32 in. deep. The same applies to the other sizes. Most tool steel welding electrodes are available in 1/16, 3/32, 1/8, 5/32 and 3/16 in. sizes. Always select the smallest electrode, especially on sharp cutting edges because less volume of heat is required. There is also less chance of creating sear marks and, after welding, less grinding will be necessary.

3. Prepare the Surface To Be Welded

In making partial repairs of cutting edges or working surfaces, rough-grind damaged areas to allow for uniform depth of finished deposits of at least 1/8 in.

In making repairs to entire cutting edges of tools or dies, rough-grind edges to be welded to an approximate 45 deg angle to allow deposits of 3/16 in. of finished metal.

In preparing for repairs of drawing and forming dies of cast structure, edges or areas to be faced should be prepared uniformly, so that finished deposits are at least 1/8 in. When preparing for extremely long deposits for forming edges or over large areas on cast structured metal, staggering of studs every 1½ in. is advisable.

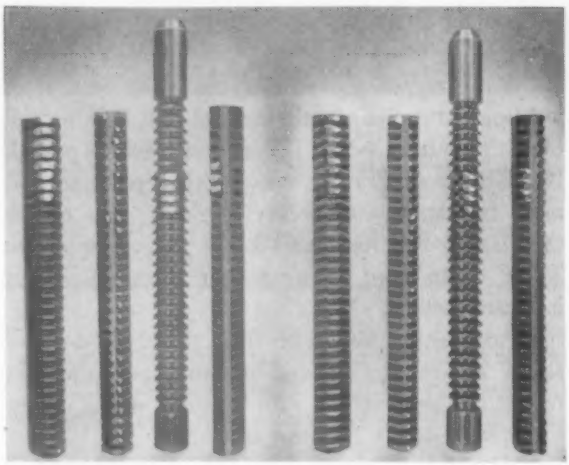
With forging die blocks, areas to be repaired should be chipped, ground or machined as uniformly as possible, to a finished depth of about 3/16 in. for the inlay deposit or, where necessary, to below the heat-checked depth.

4. Preheat the Unit

Knowledge of the type of steel to be welded will indicate the "draw range" temperatures involved. Never preheat beyond the draw range temperature while welding, since above the draw range will cause loss of hardness.

Elaborate preheating equipment is not necessary although it is desirable to use a controlled furnace whenever possible because its even soaking heat assures saturation. A slow baking heat results in saturation, since the heating can be done from the side opposite the area to be welded.

On extremely large units, preheating can be done by building an improvised brick-oven, fired with a gas-electric blowtorch. An oxyacetylene torch can also be utilized for preheating locally, but this practice is to be discouraged if the other methods are available.



Broach and three broach inserts before and after broken teeth were replaced by welding. Repair cost is a fraction of replacement cost.

Preheating Temperatures

The following are recommended preheating temperatures (deg F) to employ for the various types of tool steels:

Water hardening (water or brine quench), 250-450

Oil hardening (oil quench), 300-400

5 percent chromium air hardening (oil or air quench), 300-400

High-carbon high-chromium air hardening (air quench), 400-1000

High-carbon high-chromium air hardening (oil quench), 400-850

Tungsten-chromium varieties, hot working, 1050-1200

Chromium varieties, hot work, 900-1100

Molybdenum high speed steel, 950-1100

Forging die blocks, 600-1100

In composite fabrication the following preheats should be utilized:

Mild, medium carbon or high carbon steel, 200-400 deg F.

SAE nickel-chromium steels, 500-1100 deg F.

To aid welding operators to determine and control temperatures, especially in preheating and tempering, there are available, in stick and pellet form, products that signal accurate desired temperature by a rapid melting action. They range in 12½, 25 and 50 deg steps between 1130 and 2000 deg F.

5. Apply the Electrode

Either d-c reverse polarity or a-c current is used in applying tool and die welding electrodes. The temperature of the parent metal is kept as uniform

as possible during the welding operation to assure uniform hardness of weld depositions.

Positioning of the work is arranged so that in welding cutting edges, the deposit will flow or roll over the cutting edges. Work progresses upward, if possible, as gravity causes the deposit to roll back and builds up evenly. Gravity also causes the slag to roll back and keeps the crater clean. There is no need to weave the electrode in an intricate pattern.

In depositing beads, a slow travel is used to secure an even deposit and to assure more uniform fusion of the electrode with the base metal. Keep the area clean by frequent brushing.

Thoroughly peen all deposits to offset shrinkage and stress. Peening is a mechanical means of relieving stresses. Ball peen hammers are generally used but for large areas and inaccessible cavities, small pneumatic hammers are efficient. The value of peening weld metal (the process of working metal by means of rapid hammer blows) is well recognized and the method is commonly practiced. The chief effects of peening consist of relieving shrinkage stresses, correcting distortion, improving physical properties and also refining the metallurgical structure. Unless peening is correctly done, more harm than benefit may result. Thus the type of peening hammer, the degree of peening and the reaction of various metals to cold working should be considered. Too little mechanical work will not give sufficient advantage to make it worthwhile; on the other hand, too severe peening, especially under the improper conditions, may result in cracks or other harmful effects.

Repairing Cutting Edges

It is important not to deposit excess metal in one pass. On final passes, retain beads as close as possible to finished size. This will eliminate excessive grinding.

When welding cutting edges, to eliminate deep craters and the searing of sharp edges adjacent to the weld area, the arc should not be broken by rapidly pulling away the electrode. Lower the electrode gradually and move away.

When repairing parts of cutting edges, to eliminate craters and sear marks at the extreme end of the deposited metal, the welding bead should first progress in one direction to within a short distance of the other. Then it should progress in the opposite direction and overlap the first bead.

In welding deeply damaged cutting edges or drawing and forming surfaces, start at the bottom and gradually fill up the damaged areas, using a slightly higher amperage on the first and second beads than on finishing beads. Peening while the weld metal is in the forging state also eliminates sear marks at the edges of the depositions.

In welding two or three dissimilar types of tool steel electrodes on one die unit, care must be exercised in applying the electrodes in sequence to their draw ranges, that is, the first electrode applied must have the highest draw range and so on to the electrode having the lowest draw range. This prevents the annealing of previously applied deposits.

To effect repairs to entire cutting or forming edges of draw rings, female extrusion dies or similarly circular shaped parts, the "skip-weld" method should be used to insure even distribution of heat in the parts being welded.

During the welding operation warpage or distortion is offset by preheating to expand the units and by peening to stretch welded deposits and offset stresses. These are mechanical problems. The use of shims and clamps are helpful. For example, to prevent warpage of long shear blades of approximately 1 in. thickness by 5 in. width, when welding along the entire edge, a reverse curvature is made mechanically to allow for the shrinkage or pull of the deposition. This is accomplished by inserting $\frac{1}{16}$ x $\frac{1}{2}$ in. shims under the centerline of each 14 in. dimensions. These shims should be used every 14 in. regardless of the length of the blade and are placed under the blade and clamped down on each end of the 14 in. dimension. Each length should be completely welded and left to cool to room temperature before proceeding with welding of the other parts of the blade. Do not weld more than three lineal inches before peening, as this will tend to relieve the stress set up in the welding operation by stretching the deposited metal.

6. Post Heat or Temper Deposits or Sections

After welding, units are allowed to cool approximately to room temperature and then tempered by reheating to the recommended temperature as outlined in the manufacturers' procedure sheets. This is important, as post heating will serve as a tempering medium for the deposited metal, refining the grain structure and relieving any stress or strain set up in the welding operation.

As a general rule, in tempering deposits made to effect a partial repair, temper according to the "draw range" temperature of the base metal. If units have been repaired over entire edges or working areas, temper the deposits according to the recommended draw range etmperatures for the electrode utilized. The minimum of the draw range temperature should be employed on units for light duty work. The maximum temperature of the draw range should be used on units for heavy duty work. Specific temperature within the range depends on the size of the object. A small die will take the minimum temperature. A large one will take the maximum. In-between sizes will take temperatures that are proportional.

Tool Cuts Drilling Time

By Albert Drantz
TOOL ENGINEER
SCULLY-JONES & COMPANY

A LARGE FURNACE MANUFACTURER had the problem of drilling a 3/8 in. hole, boring one ID to 1.437 in., plus 0.005, minus 0.000; another ID to 1.477, plus 0.005; and boring an internal chamfer which caused the 1.477 in. diam to be recessed.

The job was being run on a turret lathe, and was difficult to handle because of its 14 in. length. Considerable tooling was required as well.

Using an automatically-actuated tool on a single spindle upright drill press, all operations were completed in one pass. The part was clamped in a fixture which had a hardened bushing for a tool guide. As the tool advanced and power feed was engaged, the tool bit (11) began a roughing cut for the 1.477 in. diam, and set to finish bore the 1.437 diam. The drill entered about 1/8 in., then the tool completed rough boring and began the 1.437 bore. Meanwhile the drill acts as a pilot while the tool bit bores the 1.437 in. finished diam.

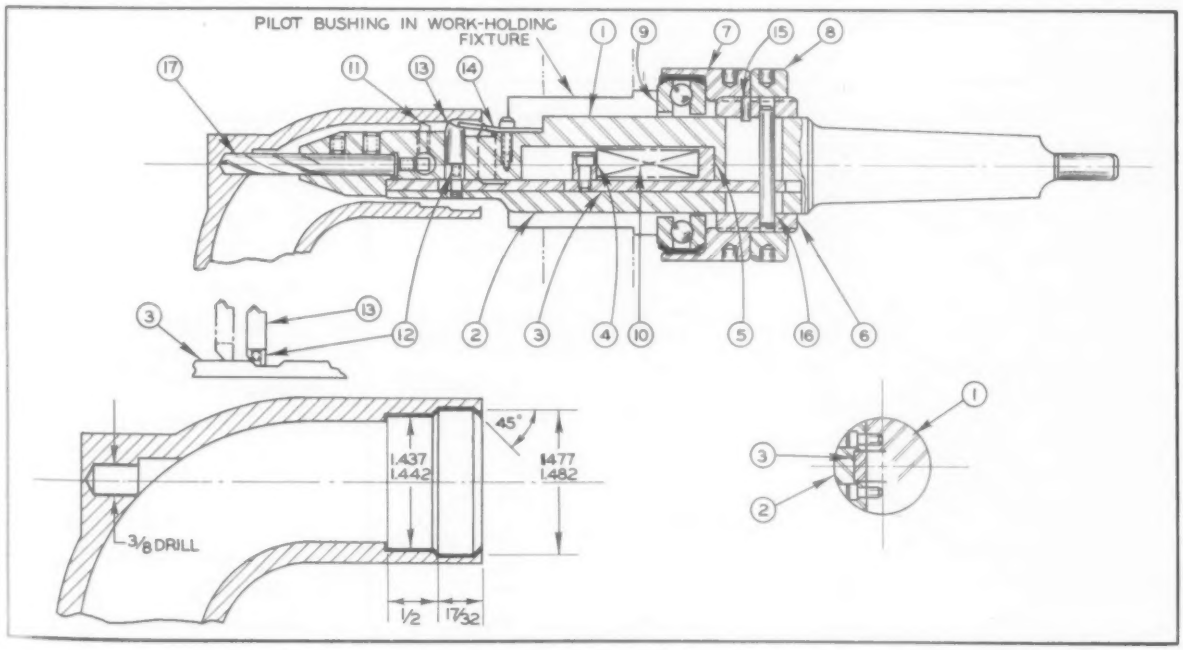
Another tool bit (13) simultaneously begins to generate the internal chamfer and recess as follows. When the ball bearing stop collar (9), which is connected by thrust collars and pins (7, 15, 8 and 6) to the actuating cam slide, bottoms on the fixture bushing, detail 3 stops the downward motion. An enlarged view of the cam slide lobe is shown, as well as the action causing the tool bit to feed out. The tool bit is revolved and fed downward. When the lead angle at bottom of detail 13 comes in contact with cam angle (3), the tool bit climbs the angle on the cam and generates the internal chamfer. The bottom of the tool bit then continues down the straight portion of detail 3 to bore the 1.477 in. diam.

When operation is completed, spring (14) pushes the tool bit back into the recess on the cam slide.

The tool saves over seven minutes in machining time over machining the part on a turret lathe. In addition, a more expensive tool is released for other work.

PARTS LIST

1. Body
2. Cover
3. Actuating cam
4. Actuating slide lug
5. Spring pad
6. Actuating collar
7. Stop collar
8. Lock nut
9. Bearing
10. Spring
11. Boring tool bit, std. 1/4 in. sq.
12. Block
13. Vee cutting tool bit 5/16 in. sq.
14. Spring
15. 3/16 in. diam. pin
16. 1/4 in. diam x 2 in. long dowel pin
17. 3/8 in. bonding drill std.



Measuring Gear Components

By Frank M. Butrick, Jr.

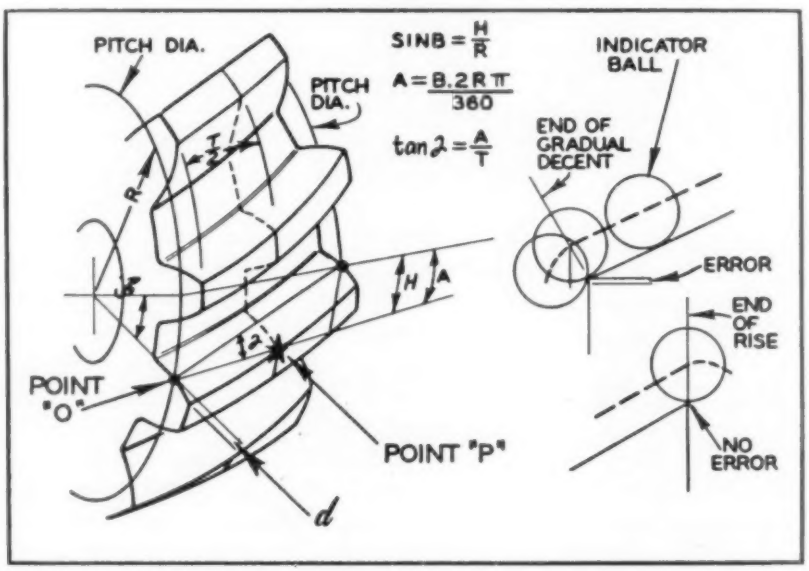
ONE OF THE MOST difficult items in the shop to measure with any accuracy is the helix angle of a helical, herringbone, or screw gear when a regular gear checking machine is not available. The following method is rather lengthy, but is fundamentally simple, doesn't require too complex calculations and, depending upon the care used and the size of the gear measured, should be accurate to within a few minutes of a degree. The inaccuracies will be discussed at the end so that the user may best judge the variation in the gear he is measuring.

Equipment Required

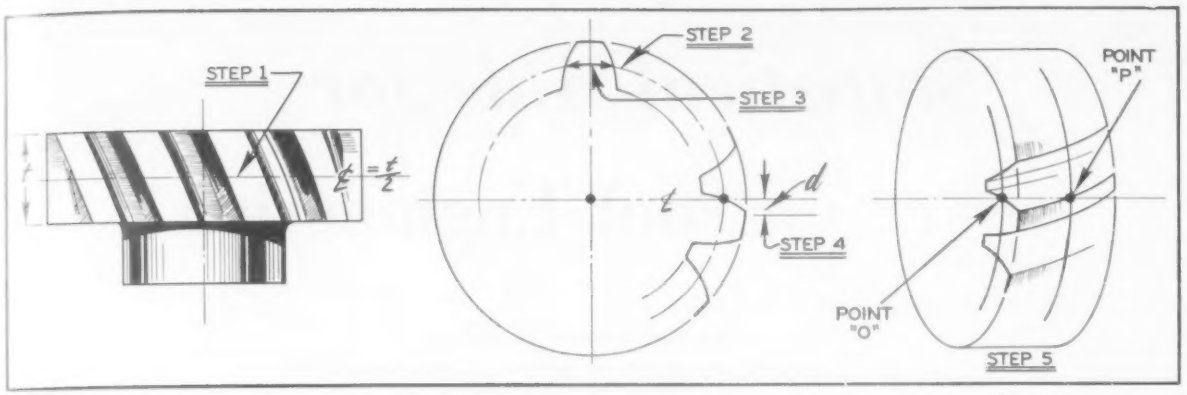
The items of equipment required consist of a surface plate, surface gage, something to clamp the gear to in an upright position, a vernier height gage and an indicator attachment. First measure the thickness of the gear, *T*. Set the scribe of the surface gage at one half of this with the height gage. With the gear lying on its side scribe a line across the top of 3 or 4 teeth. This should mark the exact center of the teeth, so projecting hubs or lugs must be considered when setting the surface gage. Also scribe a line representing the pitch diameter across the sides of the marked teeth, on both sides of the gear.

Measure Chordal Thickness

Now, on the edge of the gear, measure the chordal thickness and thickness of a tooth at the OD, parallel to the side of the gear. This is not the usual way these measurements are obtained, but must be done so for our use here. Subtract the thickness, divide by two, and mark it down as *d*. Now set the gear on edge on the surface plate, and



Nomenclature and setup for determination of angles on herringbone, helical and screw gears.



Step 1: Scribe line on centerline of gear face. Step 2: Scribe line corresponding to pitch circle. Step 3: Measure chordal thickness. Step 4: Subtract thickness at OD from chordal thickness, divide it by two, and call it *d*. Step 5: Set gear on edge and roll until point where *P* is true with point *Q*, and the scribed straight line is one-half the OD minus *d*, high.

roll it until the point where the line scribed on the OD of one of the teeth meets the upper face of that tooth—marked point *P* in the sketch—is half the OD minus the *d* just obtained, high. Set it with the height gage, be certain that it is right, and clamp the gear securely. This is to ensure that the only important measurement, which follows, is made exactly vertical.

Helix Angle

The tooth which we just used to set up the gear is the one on which we will measure the helix angle. Slide the height gage with the indicator clamped on it up and obtain a reading on the low side of the tooth even with the pitch diameter. This is a rather delicate operation, and will require some care. With the indicator ball following the slope of the tooth down, when the needle stops its uniform decline and starts to show a more rapid drop, that is your point. Set the indicator dial to zero, and then take the vernier reading, and record it.

Now, take the measurement at the high end of the tooth, with the indicator ball even with the PD. On this end, slide the indicator ball up the slope of the tooth until it halts its rising momentarily prior to its dropping off. This is the point we desire, so adjust the height gage until the indicator reads zero, and take the vernier reading. Subtract the previous reading from this one, and label the balance *H*. Our calculations now follow, and we require the thickness *T*, the OD, the PD, and the measurement *H*.

Applying Formula

The first formula is the sine of β equals *H* divided by the pitch radius, *(R)*. Solve for β, resolve it into degrees and decimal parts thereof, and use it to locate the peripheral measurement *A*. In the formula, *A* equals β times the pitch diameter, PD times π over 360. Having obtained *A* we find the tangent of the desired angle γ, by dividing *A* by *T*. The helix angle is γ. If the edge between the top face of the gear and the OD is sharp enough, that may be used instead of the PD. In this case, we do not need to scribe the PD on the gear sides, and the point marked with a star in the sketch is set exactly half the OD high. Substitute a sharp scribe point for the indicator here, and align the scribe point and gear corner visually to obtain the measurement *H*. Substitute the OD for the PD in the calculations above, and then solve for the helix angle on the pitch diameter by multiplying the angle obtained in the calculations by the PD and divide by the OD.

Inaccuracies Slight

The inaccuracies of this method are slight, but must be understood by the user. First, scribing the PD on the tooth should be done with care, but a few thousands will not affect the measurement as the indicator ball must be aligned with the mark visually, and that is the source of the principal inaccuracies. However, even these should not bother much as the PD is somewhat flattened radially on most gears. As for locating the exact slope edge with the indicator ball, the sketch shows the minute errors encountered plainer than words. All that need be said here is that the finer the indicator ball, the better. All in all, the second way, using the OD rather than the PD is somewhat more accurate, as it is easier to align two sharp points than a line and a ball; and because measurement errors on the OD are reduced a little when calculated back to the PD.

Statistical Aids for

Tool Engineering

By Lawrence E. Doyle

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Part II a

CONTINUING OUR DISCUSSION of specific types of distributions, we shall consider next the rectangular distribution. Fig. 5A represents the distributions of the deviations occurring in a process which is producing an appreciable proportion of dimensions outside the desired limits $-T_1/2$ and $T_1/2$. If all parts outside of limits are rejected by the inspectors, those will be represented by the shaded area. Fig. 5B is typical of a process where tool wear is an important factor. The tool is set to the low limit. The dimension cut is near the low limit for a while, but gets larger as the tool wears. Near the high limit, the tool is replaced or resharpened. The cycle is then repeated, again and again. Distributions under the two circumstances referred to are approximately rectangular in shape. A like form may also be encountered where few pieces are produced in any one case, more or less uniformly spread over the tolerance range.

A typical rectangular distribution is represented by Fig. 5C. The height of the rectangle is a constant, m. The area of the rectangle is unity, so

$$T_1 m = 1, \text{ and } m = \frac{1}{T_1} = f_1(x_1) \qquad (7)$$

Let another rectangular distribution between the limits $-T_2/2$ and $T_2/2$ be added to the first. Assume T_1 larger than T_2. Equation (6) now has the form

$$f_a(x_a) = \int \frac{1}{T_1 \cdot T_2} dx_2 \qquad (8)$$

The limits of integration should be $T_2/2$ and $x_a - T_1/2$. That is, all values of x_2 between $T_2/2$ and $x_a - T_1/2$ are added together. The upper limit is the largest value that can be assigned to x_2. The lower limit corresponds to the minimum value of x_2, which is $-T_2/2$. These limits give results significant for $f_a(x_a)$ when x_a lies between $\frac{T_1 - T_2}{2}$ and $\frac{T_1 + T_2}{2}$. Thus

$$f_a(x_a) = \int_{x_a - \frac{T_1}{2}}^{\frac{T_2}{2}} \frac{1}{T_1 \cdot T_2} dx_2 = \frac{(T_1 + T_2 - xa)}{2} \qquad (9)$$

If n rectangular distributions having respective tolerance limits of T_1, T_2, T_3 — T_n are combined in the same way, the resultant curve is

$$f_a(x_a) = \frac{(T_1 + T_2 + T_3 + — + T_n - 2x)^{n-1}}{(n-1)!\, 2^n \cdot T_1 \cdot T_2 \cdot T_3 \ldots T_n} \qquad (10)$$

What is wanted is the value of a tolerance T_p such that the probability is p of getting variations greater than T_p. Thus, if we will accept 2 percent defective assemblies, $p = 0.02$. We expect that T_p will be less than $T_s = T_1 + T_2 + T_3 + \ldots + T_n$. But because of the restrictions imposed upon equation (9), and likewise upon equation (10), T_p cannot be less than $(T_s - 2T_2)$, where T_2 may be the second largest tolerance in the set.

The probability $p/2$ is the area under the resultant curve between the limits of $T_p/2$ and $T_s/2$. This may be expressed by

$$\frac{p}{2} = \frac{1}{(n-1)!\, 2^{n-1} T_1 \cdot T_2 \cdot T_3 \ldots T_n} \int_{\frac{T_p}{2}}^{(T_1 + T_2 + T_3 + \ldots + T_n)/2} (T_1 + T_2 + T_3 + \ldots + T_n - 2X_a)^{n-1} dX_a$$

$$= \frac{(T_1 + T_2 + T_3 + — + T_n - T_p)^n}{(n)!\, 2^n T_1 \cdot T_2 \cdot T_3 \ldots T_n} \qquad (11)$$

That expression solved for T_p gives

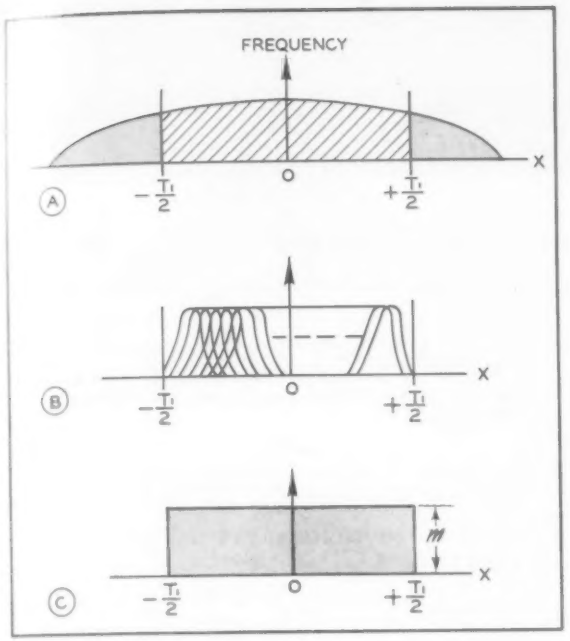

Fig. 5. Some types of distributions. At *A* there is considerable deviation outside limits. Cycle of tool wear is shown at *B*, where tool is replaced as distribution reaches high limit. At *C* is a rectangular distribution.

$$T_p = T_1 + T_2 + T_3 + \ldots + T_n$$
$$- 2\sqrt[n]{(p/2)n!\ T_1.T_2.T_3.\ \ldots T_n} \qquad (12)$$

Example 3. Suppose the dimensions indicated in Fig. 1 all have variations distributed in rectangular form. It is desired that at least 99.7 percent of the assemblies shall be within specified limits. What shall be the tolerance of the overall thickness of the three gears? What variation shall be specified for the clearance *C*?

For the tolerance of the overall thickness of the gears:

$$T_{gp} = 0.004 + 0.004 + 0.004$$
$$- 2\sqrt{(0.003/2) \times 3! \times 0.004 \times 0.004}$$
$$= .012 - 2X\ .004 \times \sqrt[3]{0.0015 \times 3!}$$
$$= .012 - .0014 = 0.0106 \text{ inch.}$$

The combined gear thickness should therefore be 3.000 ± 0.0053 inches.

For the variation in the clearance,

$$T_{cp} = .018 - 10^{-3}$$
$$\times 2\sqrt[4]{.0015 \times 4! \times 4 \times 4 \times 4 \times 6}$$
$$= .018 - .0008\sqrt[4]{540}$$
$$= 0.0142 \text{ inch or } \pm\ 0.0071 \text{ inch.}$$

Example 4. Assume that the tolerances shown in Fig. 2 are the confines of rectangular distributions. What tolerance for dimension *R* will probably include 99.7 percent of the parts produced? What variation can be expected in the stock removal? For the tolerance of dimension *R*,

$$T_{rp} = .004 + .002$$
$$- 2\sqrt[2]{.0015 \times 2 \times 4 \times 2 \times 10^{-6}}$$
$$= .006 - 3.1 \times 10^{-4} = 0.0057 \text{ inch.}$$

For the variation in the stock removal,

$$T_{sp} = .010 + .004$$
$$- 2\sqrt[2]{.0015 \times 2 \times 10 \times 4 \times 10^{-6}}$$
$$= .014 - 4 \times 10^{-4}\sqrt{3} = 0.0133 \text{ inch.}$$

The Effect of the Original Distribution

The largest possible variation in the clearance *C* of Fig. 1 is 0.018 inch. As shown in Example 3, if the individual distributions are rectangular, 99.7 percent of the variations of the clearance can be expected to be within 0.014 inch. Also according to Example 1, if the distributions are normal, the same proportion of variations will probably be within a little more than 0.009 inch. The variation in the clearance results from the accumulation of four tolerances.

The greatest possible variation in dimension *R* of Fig. 2 is 0.006 inch. According to Example 4 for rectangular distributions, that is reduced to only 0.0057 inch. As shown in Example 2, if the distributions are normal 99.7 percent of the parts may be expected to be within a tolerance of only 0.0047 inch. But dimension *R* results from the accumulation of only two tolerances.

These examples give indications of what happens when distributions are added. If a large number of distributions are added together by the random selection and combination of their items, the resultant distribution approaches that of a normal curve. That is true no matter what the forms of the individual distributions. However, the closer they are to normal in the beginning and the more there are of them, the nearer the resultant is to normal. The limiting case is that of normal components. The resultant of any number of them is normal. Thus, in the examples the saving is less for the rectangular distributions than for the normal distributions. But for the rectangular distributions, the reduction in tolerance is 2/9 where four tolerances are added, but only 1/20 for two tolerances.

Triangular Distribution

A triangular distribution, like that of Fig. 6 between $-T_1/2$ and $T_1/2$, is a form between the normal and rectangular distributions. The area within the triangle is equal to unity and any ordinate has a value

$$f_1(X_1) = \frac{T_1/2 - |X|}{\frac{T_1^2}{4}} = \frac{2T_1 - 4|X|}{T_1^2} \qquad (13)$$

The high point of the distribution, at X = 0, has a value of $2/T_1$.

If the method for deriving equation (12) is applied to a set of triangular distributions, a corresponding formula is obtained in the following form:

$$T_p = T_1 + T_2 + T_3 + \ldots + T_n$$

$$\sqrt[2n]{(p/2)\ (2n)!\ T_1^2 \cdot T_2^2 \cdot T_3^2 \ldots T_n^2}$$

$$= T_1 + T_2 + T_3 + \ldots + T_n$$

$$\sqrt[2n]{(p/2)\ (2n)!}\ \sqrt[n]{T_1 \cdot T_2 \cdot T_3 \cdot \ldots\ T_n} \quad (14)$$

By this formula, a tolerance T_p is specified which gives a loss not exceeding p percent when a set of individual tolerances (T_1, T_2, T_3 ... T_n) are added together.

Example 5. Suppose the dimensions indicated in Fig. 1 have variations distributed in a triangular form. For 99.7 percent good assemblies, what variation shall be specified for the clearance C?

$$T_{cp} = .018 - 10^{-3}\sqrt[8]{.0015 \times 8!}\ \sqrt[4]{4 \times 4 \times 4 \times 6}$$
$$= .018 - .0074 = 0.0106 \text{ in.}$$

This tolerance is only about 0.0015 inch larger than that for normal distributions under the same conditions.

Example 6. Assume that the tolerances shown in Fig. 2 are the confines of triangular distributions. What tolerance for dimension R will probably include 99.7 percent of the parts produced?

$$T_{rp} = .006 - 10^{-3}\sqrt[4]{.0015 \times 4!}\ \sqrt{8}$$
$$= .006 - .0012 = 0.0048 \text{ inch.}$$

Summary

Whether dimensions are added or subtracted, their tolerances accumulate. If all possible deviations of a resultant dimension are to be taken into account, its tolerance must be the sum of the tolerances of all its components. But it is usually likely that comparatively few of the deviations of a resultant dimension will be near the extreme limits. Thus, it often may be practical to set resultant tolerances inside of those that take into account all possibilities. Statistical methods are useful in estimating the loss that may result from reducing tolerances, or conversely, the desirable tolerance for an acceptable risk.

The distribution of variations of a resultant dimension depends upon the forms of the component distributions and upon how the individual parts are selected.

If a set of normal distributions are added together, they produce another normal distribution. Tolerances of normal distributions are often associated with $\pm 3\Delta$ limits, within which 99.7 percent of the variations are likely to be. On that basis, an acceptable resultant tolerance is:

$$T_p = \sqrt{T_1^2 + T_2^2 + T_3^2 + \ldots + T_n^2},$$

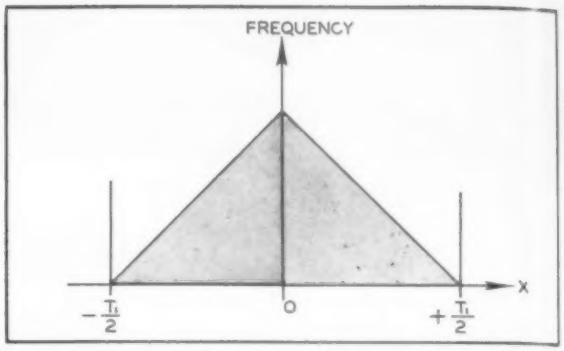

Fig. 6 A triangular distribution, representing a form between normal and rectangular distributions.

where T_1, T_2, T_3, etc. are the component tolerances.

When distributions that are not normal are added, their resultant does not necessarily assume the same form. For such distributions, the probable results must be computed from the properties of the components. Where tolerances confine rectangular distributions, an acceptable resultant tolerance for a probable loss, p, is

$$T_p = T_1 + T_2 + T_3 + \ldots + T_n -$$
$$2\sqrt[2n]{(p/2)n!\ T_1 \cdot T_2 \cdot T_3 \cdot \ldots\ T_n}$$

A suitable tolerance for the sum of a set of triangular distributions is

$$T_p = T_1 + T_2 + T_3 + \ldots + T_n -$$
$$2\sqrt[2n]{(p/2)\ (2n)!}\ \sqrt[n]{T_1 \cdot T_2 \cdot T_3 \ldots\ T_n}$$

The meaning of the symbols in these expressions are given in connection with equations (2), (12), and (14) in the text.

If a number of distributions are added together, their resultant approaches a normal distribution. The larger the number and the nearer they are to normal, the closer their resultant approximates a normal distribution.

Obviously, it is desirable to be able to get a picture of how the variations of manufactured dimensions are distributed. Such an insight is not only helpful in arriving at resultant tolerances but is also useful in applying statistical methods to other tool engineering problems. The next article of this series will include a discussion of the factors that influence distributions and the techniques for measuring actual distributions.

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Brunt, David, ***The Combination of Observations*****, Cambridge Univ. Press, 1931.**

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JIC Hydraulic Standards for Industrial Equipment

HI. 3 Standard Symbols

H1.4—Fluid Legend Code

H1.4.1 Color Code

Function	Color
Intensified pressure	Black
Supply Pressure	Red
Charging pressure Reduced pressure	Intermittent Red
Metered Flow	Yellow
Exhaust	Blue
Intake Drain	Green
Inactive	Blank

H1.4.2 Pattern Code

Function	Zip-A-Tone Pattern & No.
Intensified Pressure	#7R
Supply Pressure	#177
Charging Pressure Reduced Pressure	#52-0
Metered Flow	#63
Exhaust	#75
Intake Drain	#16
Inactive	Blank

H1.4.3 Definition of Functions

Function — **Definition**

Intensified Pressure: Pressure in excess of supply pressure and which is induced by a booster or intensifier.

Supply Pressure: Power actuating fluid.

Charging Pressure: Pump-inlet pressure that is higher than atmospheric pressure.

Reduced Pressure: Auxiliary pressure which is lower than supply pressure.

Metered flow: Fluid at controlled flow rate; other than pump delivery.

Exhaust: Return of power actuating fluid to reservoir.

Intake: Sub-atmospheric pressure, usually on intake side of pump.

Drain: Return of leakage or control actuating fluid to reservoir.

Inactive: Fluid which is within the circuit but which does not serve a functional purpose during the phase being represented.

H1.5—Diagram Size

H1.5.1 All diagrams shall be of such size as to clearly disclose all components of the systems. Diagrams shall be folded to 8½ x 11 in. file size.

H2—Hydraulic Controls

H2.1—Definition of Controls

(A) Manual controls are those actuated by the operator, regardless of means.

(B) Automatic controls are those actuated in response to the cycle of the equipment.

H2.3—Protection

H2.3.1 Over-pressure protection shall be provided on the discharge side of all pumps. The adjustments on the pressure control units shall be accessible. Provision shall be made to permit locking enclosure or compartment in which pressure control unit is mounted, or protective locking type adjustments shall be provided to prevent tampering.

H2.3.2 All pressure controls shall be so constructed as not to be adjustable outside nominal working ranges, and shall be marked to indicate nominal minimum and maximum pressures.

H2.3.3 Where there is more than one pump on the equipment and possible damage may be caused by the stoppage of any one pump, interlocks shall be provided so that the stoppage of one pump in the circuit will not endanger or damage the equipment. Where the starting of the pump in an improper sequence can result in damage, interlocks shall be provided to insure the starting of all pumps in proper sequence.

H2.3.4 All necessary valves for removal of any pump while other pumps are still in operation shall be provided.

H2.3.5 Where pumps are operating in series, pressure protection shall be placed between pumps in series in order to protect any pump from carrying the entire load. (This will not apply to centrifugal pumps in series.) All conductors between pumps shall be of adequate strength for the intended pressure.

H2.3.6 Where loss of working pressure on discharge side of pump or pumps may result in damage to equipment, loss of accuracy, or danger of injury to personnel, means shall be provided to prevent operation under those conditions. When lubricating pumps are used as set forth in Paragraph H0.6 (B) the same conditions shall prevail.

H2.4—Controls—Circuit

H2.4.1 When shifting from rapid traverse to feed, the starting position of the feed rate shall be maintained consistent with the type of service required.

H2.4.2 Hydraulic circuits shall be so designed as to minimize the generation of heat and to conserve power.

H2.4.4 In each electrically controlled circuit, in case of solenoid failure, means shall be provided to prevent damage to equipment, loss of accuracy, and danger of injury to personnel.

H2.4.5 Neutral valve positioning controls shall be independent of and unaffected by adjustment of other controls.

H2.4.6* Where practicable, feed and cycle limiting trip devices on mass production equipment shall be so arranged that the feed distance can be set and sealed. After feed distance is pre-set, the control mechanism shall be adjustable as a unit.

H2.4.7 (A) Positive position stops shall be so designed that the dwell time will not be affected when positive position stops are reset.

(B) Positive safety stops for machine slides shall not be adjustable, but shall have provision for replacement.

H2.4.8 On industrial equipment operated at elevated temperatures or with toxic materials, the circuits shall be so designed and located that they can be serviced while equipment is operating under these conditions.

H2.4.9 Hydraulic circuits shall be so designed, constructed and applied that unnecessary surge pressures are minimized at their source, and equipment shall be of adequate strength to withstand all operating pressures and surge pressures.

H2.4.10 Hydraulic circuits shall be so designed as to prevent uncontrolled movement of the equipment operating devices in all phases of the equipment cycle including the idling phase.

H2.4.11 Hydraulic feed circuits shall be so designed and applied as to maintain consistent feed rates irrespective of reverse force or intermittent loads.

*(See Engineering Developments)

JIC Hydraulic Standards for Industrial Equipment

H2.4.12 Circuits having two or more heads, slides, or actuators, shall be provided with means to insure all units operating in proper relation regardless of load variation.

H2.4.13 Hydraulic circuits in mass production equipment shall be so designed and applied that load variations, and changes in fluid temperature ranges if automatically controlled, shall not cause variations in the cycle time of more than plus or minus 3, 5, 10, 15 percent of the specified basic cycle provided voltage, frequency, and manual operations do not change. Purchaser shall advise the percentage of degree of accuracy required.

H2.5—Enclosures and Compartments

H2.5.1 For the purpose of these standards, an enclosure means a housing for hydraulic apparatus. A compartment means a space within the base, frame, or column of the equipment.

H2.5.2 Automatic controls that might be damaged by exposure to dirt or dust or stock moving equipment shall be adequately protected and readily accessible.

H2.5.4 Doors and other parts of compartments for automatic controls shall be sheet steel not less than 14 USS gage, or cast metal not less than ¼ in. thick. Compartments for automatic controls shall be completely isolated from coolant, cutting or lubricating oil, chips and dirt. All automatic control devices shall be mounted in one enclosure where possible and advisable.

H2.5.6 All enclosures for control devices, where practicable, shall have hinged covers which swing horizontally, or self-supporting sliding covers, and shall be held closed with screws which require the use of a tool (wrench or screw driver) to remove.

H2.5.7 The arrangement of enclosures for mounting controls shall permit ample room for proper maintenance.

H2.6—Mounting

H2.6.1 (A) All Controls: All controls shall be mounted so as to minimize the possibility of damage from floor trucks or other stock moving equipment. They shall be protected against falling objects and operator's accidental movements. No controls shall be placed in high heat areas or in locations subject to any harmful conditions.
(B) Manual Controls: All manual controls shall be mounted within reach of the operator when in his normal operating position. Operator shall not be required to reach past revolving spindles or moving tools to reach manual controls. (See Paragraph H7.1.2)
(C) Automatic Controls: Automatic controls shall be so located and protected as to prevent inadvertent operation.

H2.6.2 All hydraulic controls shall be mounted two feet or more above the bottom of the equipment providing such mounting will not impair the proper functioning of the circuit. (This paragraph is written as a guide for all new machinery and equipment with the understanding that any deviation will be in accordance with Paragraph H0.2.)

H2.6.3 Hydraulic control units shall be mounted in positions which provide complete accessibility to all units for maintenance without interfering with adjacent equipment.

H2.6.5 All industrial equipment shall incorporate an emergency stop control readily accessible from operator's normal position.

H2.6.6 Internal leakage must be drained to reservoir or vented manifold to prevent blocking of plunger type controls.

H2.6.7 Piping shall not be used as a means for supporting valves or equipment where vibration may prove detrimental to piping.

H3—Pumps

H3.3—Mounting Pumps

H3.3.1 (A) Pumps, or subassemblies including the pumps, shall be readily accessible for maintenance.
*(B) Pumps shall not be mounted inside reservoir.

H3.3.2 Pumps shall be mounted where they are adequately protected from damage.

H3.3.3 When pumps and other apparatus are mounted inside the compartment or enclosure, sufficient space must be provided to assure complete accessibility to all units.

H3.3.4 Pump compartments must be clean and free of moisture and adequately vented to the exterior of the industrial equipment and all openings must be of sufficient height above the floor or be protected to such an extent that dirt, chips, coolant, etc., cannot enter, especially at such times as floor is swept or washed, or the equipment is cleaned. Unless other compartments meet the requirements of the pump compartment, there shall be no openings of any kind between the pump compartment and any other compartment.
If piping is run into the pump compartment from another compartment not meeting the pump compartment requirements, adequate seals shall be provided.

H3.3.5 Direct-coupled pumps must be properly aligned and securely mounted in such a manner as to assure alignment under normal operating conditions. When mounted inside column or base of equipment, foot-mounted pumps and driving motors shall be mounted on a sub-base of adequate strength which can be easily removed for servicing. The coupling must have adequate capacity to transmit the power required.

H3.5—Pump Nameplates

H3.5.1 The following information shall be permanently indicated on each hydraulic pump.
(A) Manufacturer's name and address.
(B) Manufacturer's identifying part number.
(C) Manufacturer's serial number, if any.
A data sheet or catalog providing complete information on speed limits, pressure range, delivery, horse-power required, and viscosity range, shall be provided with the specifications.

H3.5.2 Whenever a pump is mounted so that its nameplate is not readily visible, a plate with duplicate information shall be provided where it can be readily seen. Such duplicate plate shall be marked "duplicate". The nameplate shall not be removed from the pump.

H3.5.3 The direction of rotation of each pump shall be clearly indicated on the pump where it can be readily seen.

Engineering Developments

Standards specifications noted with an asterisk (*) were written as a guide in indicating the type of engineering that is considered to be desirable in new developments and in the re-engineering of equipment.

Electrolux Corporation:

Volume Production Means Effective Materials Handling

By Gilbert P. Muir

"IT'S THE LITTLE things that count" in successful manufacturing, said Arthur F. Murray, works manager of successful Electrolux Corporation's high-volume plant at Old Greenwich, Connecticut. And in this quiet old New England town attention to details turns production orders into vacuum cleaners at a rate that does credit to the principle.

Some years ago Tool Engineer Murray, explaining his point, made the following observation: "A smoothly operating low-cost, efficient, profitable production line is not only a matter of capital equipment (buildings, machinery and tools) manned by skilled and cooperative personnel, but is dependent on little details in design of product, production tooling and materials handling . . ."

Electrolux has literally done wonders with this philosophy—wonders which can quickly be transferred into statistics. Production has been at a rate of four times prewar, with only a 50 percent increase in factory space and a doubling of personnel. The principle has been translated into intensified study of materials handling practices, operation layouts, machining setups and tooling, and incentives that work. And responsible for these accomplishments are company policy and Arthur Murray's team.

Electrolux pioneered the introduction of the cylinder-type vacuum cleaner in the United States, and over the years its door-to-door sales method appears to have had considerable influence in corporate policy on matters other than selling, as we shall see.

The company has found incentives a valuable tool in breaking previous sales records, and use of the tool was easily broadened to include production as well as sales. One result is a pool which last year amounted to more than $1,300,000 distributed in bonuses and other benefits among the plant's 1700-odd employees.

The counter (upper right) clicks with each new cleaner

Probably more important than the mere existence of these fringe benefits is the time of their introduction and the thinking behind their establishment. For example, a timetable of their institution would read as follows: group life and disability insurance, 1935; service bonus, 1936; two-weeks paid vacation for hourly-rated employees, 1938; with additional time for long service in 1948. An employee participation pension plan was inaugurated in 1946. Industrial relations is an important activity. The significant factor in these provisions for employees is that for a company of moderate size they represent a sizeable yearly investment. Secondly, they have been company-sponsored.

To understand the nature of an organization we must study the men behind it. Arthur Murray, works manager of Electrolux since 1943, is the exception to the general policy that has brought virtually all supervisors and department heads up from the ranks rather than from the outside.

Mass production assembly and small motor manufacture were no strangers to Tool Engineer Murray when he joined Electrolux. A Westinghouse veteran since World War I, he had lived with motor and assembly problems first with the old New England Westinghouse Electric Company and then the organization which succeeded it; ultimately joined Westinghouse's Headquarters Manufacturing Engineering staff to study and establish manufacturing and standards programs.

The team at Old Greenwich is a strong one, and dispenses with red tape to the extent that *The Tool Engineer's* attempt at sketching an organization chart soon developed into a tangle of lines wherein everybody was in on everything. From his corner office on the second floor, Arthur Murray pretty much runs the show without interference from the

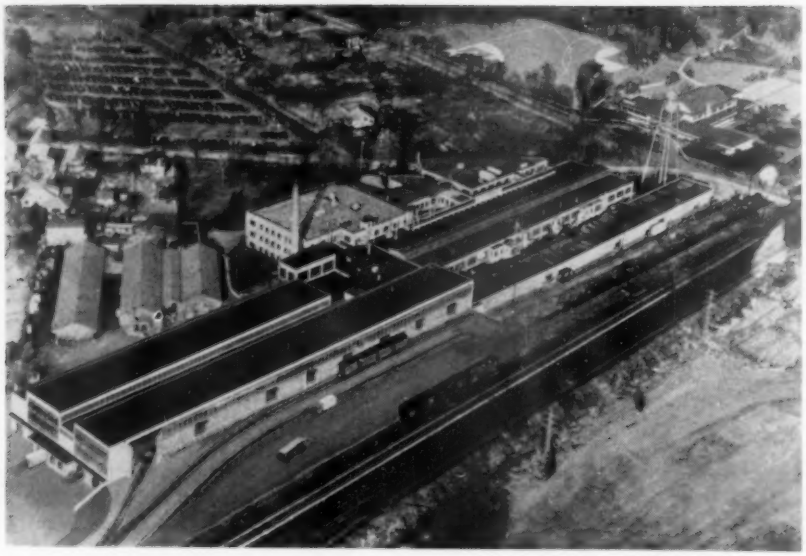


Fig. 1. Air view of Electrolux's Old Greenwich, Conn., plant

executive offices in New York. Here a conversation is punctuated by the steady click of a counter, mounted on the wall beside his desk, which ticks off another digit every time a vacuum cleaner leaves the final assembly line for the shipping room.

The front-line team includes G. W. Norrick, assistant works manager; G. E. Lofgren, director of research; F. C. Doughman, chief engineer; M. E. Hodges, plant engineer; C. M. Harris, production manager; Russell Seversen, controller; Philip Worth, chief inspector; Gene Laistner and Joe Byrnes, senior manufacturing engineers. Machining operations and electrical and assembly production are divided into two major divisions, with Fred Barney heading up the former as general foreman, and William Ferris holding the same title over the latter. Plant layout engineer, and responsible for much of the conveyor-aided processing, is James Brown.

We shall now have a look at some of the team's scores.

Materials Handling

"In these days of high costs for manpower, equipment and floor space, machining and assembly is primarily a problem of efficient materials handling." This quotation is from one of the many papers presented before engineering groups by Mr. Murray.

The Electrolux plant at Old Greenwich involves two-story operation in a large part of its production, which makes materials handling on a large scale considerably more than a passing problem.

Total floor space of the plant approximates 375,000 sq ft, of which 100,000 sq ft is devoted to a new warehouse designed to replace a half-dozen temporary warehouses rented during the war.

As mentioned earlier, production at Old Greenwich has expanded more than four times prewar with an increase in factory space of only 50 percent. This means closely-coordinated materials handling, since it is possible to carry only a two-to-three-days' supply of parts within the plant.

Therefore one of the major materials handling solutions was conveyorizing on a large scale. Overhead conveyors are utilized not only for transmission of parts and material between operations, but in addition as "traveling warehouses" for such cushion storage as is needed.

Overhead conveyors are supplemented by portable roller conveyors, fork trucks and trailers, portable belt conveyors and about 9,000 double-faced pallets.

The problem of containers for parts and material during storage and in-plant movement has been for the most part solved by extensive use of suppliers' cartons. Electrolux has worked with major suppliers consistently with a view to using original cartons or containers exclusively for parts handling, with the result that over the past three years costs for in-plant containers have dropped nearly $20,000 per year.

Two other factors have reduced incoming materials handling costs—source inspection at suppliers' plants, and palletizing or skidding of parts and material from vendors. At present 15 vendors supply 85 items on skids or pallets of their own design, some of which are expendable and others returned to the supplier.

Plant Layout

In the broad sense of materials handling as the most important phase of manufacturing in many industries, it is certainly a basic factor in floor layout and organization of production. Tool Engineer Murray has defined seven fundamentals in modern manufacturing, which follow:

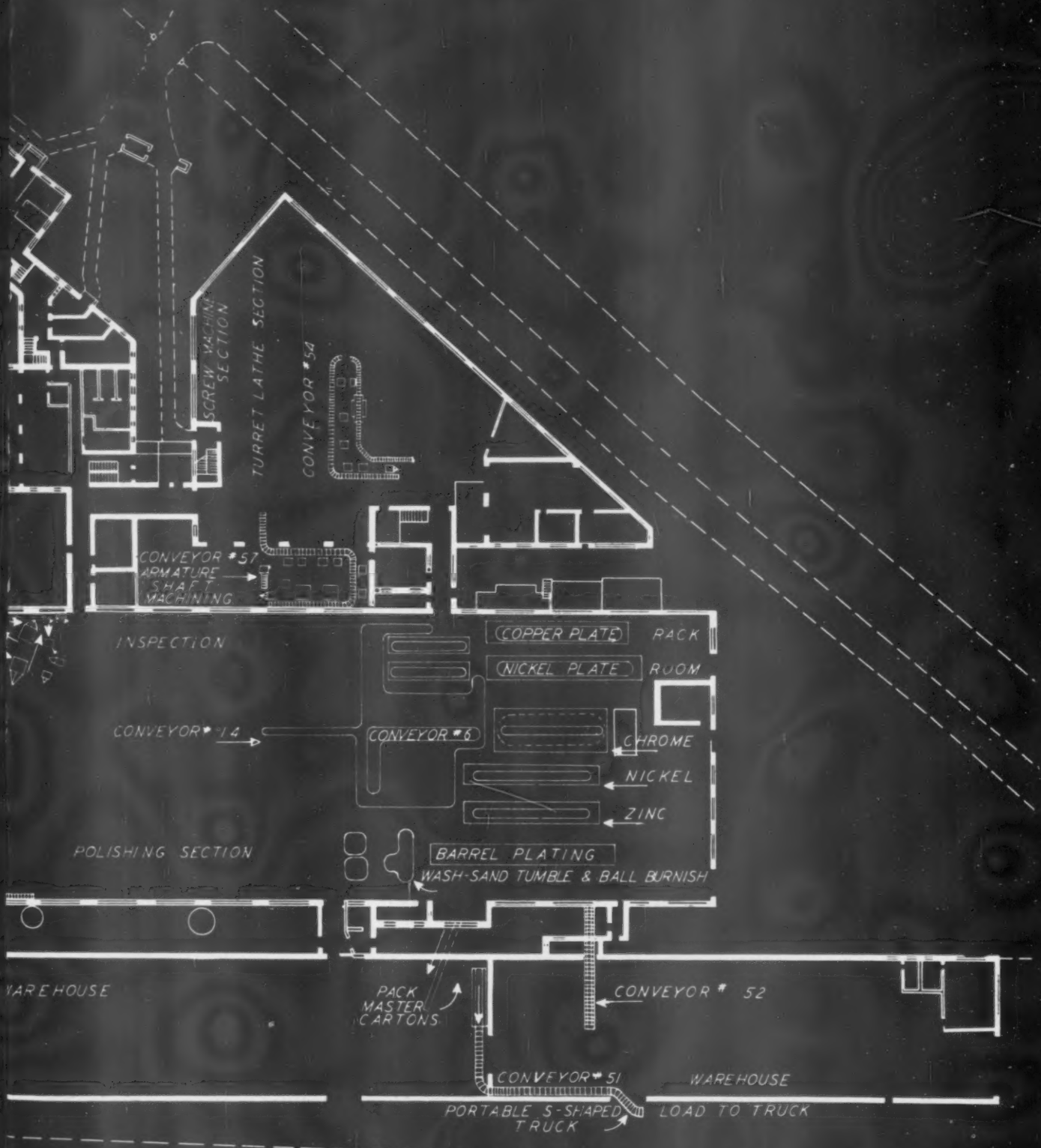
1. Machines and tools now cost so much that we must keep them cutting or forming metal—not waiting for manipulation of clumsy fixtures or series operation of assorted levers and clamps.
2. The fatigue element of all this handling, with listing of parts singly or in multiple containers, results in steadily declining production by the operator from start to finish of shift.
3. Jobs requiring great physical

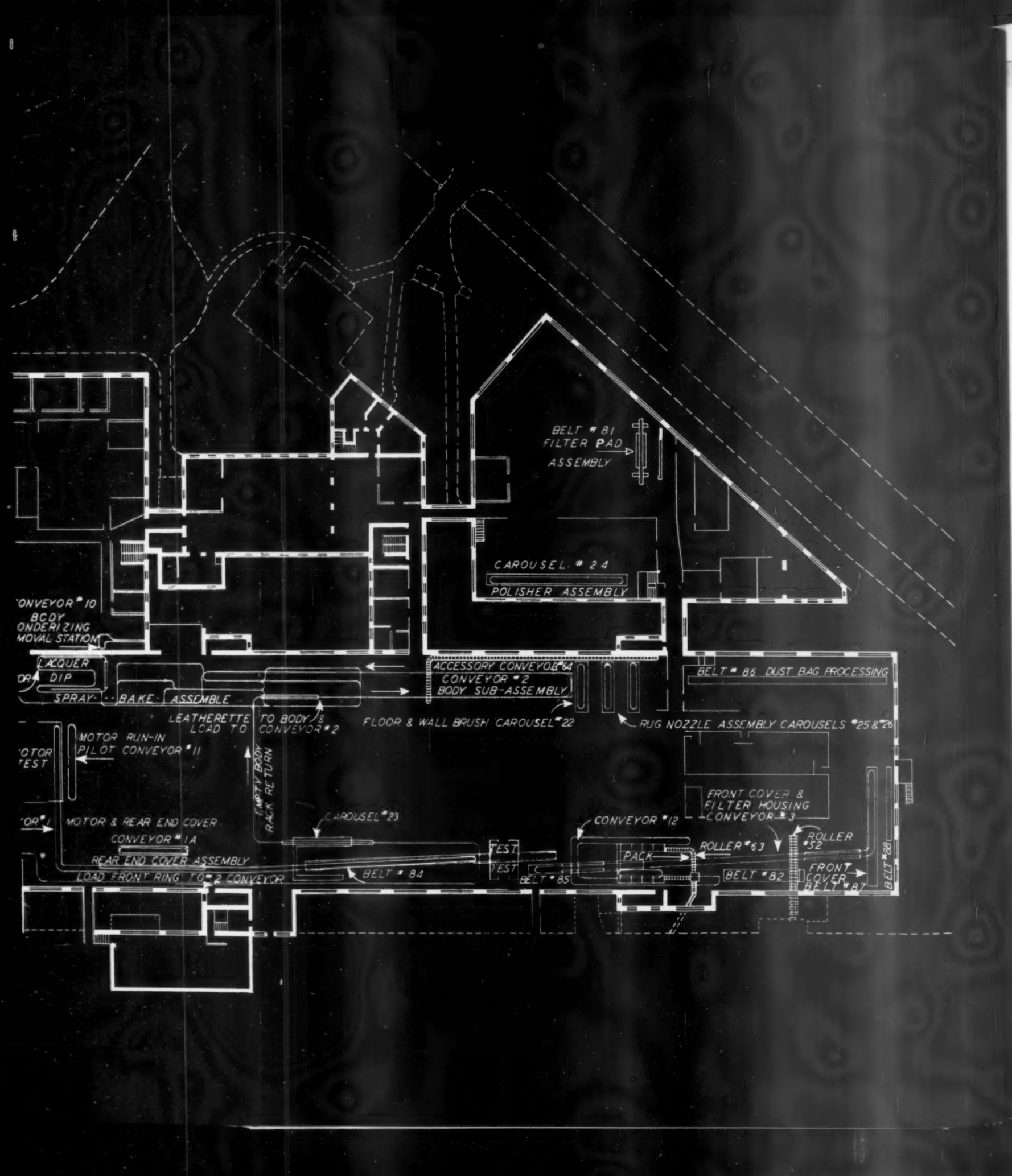
➡

FIRST FLOOR LAYOUT

(Fig. 2) shows flow of material and parts from warehouse (left) through metal stamping, polishing and plating. Machining section is at upper right.

TOOL ROOM
CAFETERIA
SCREW MACHINE SECTION
TURRET LATHE SECTION
CONVEYOR #54
CONVEYOR #10
BODY BONDERIZING
CONVEYOR #57
ARMATURE SHAFT MACHINING
INSPECTION
BONDERIZE
CONVEYOR #55
BODY WELDING
PRESS-VEYORS
PRESS-VEYORS
BOILER ROOM
HEAT TREATING
PRESS SECTION
CONVEYOR #14
CONVEY
CONVEYOR #15 REAR END COVER
LAMINATION PRESS SECTION
CONVEYOR #53
TUBE PROCESSING
POLISHING SECTION
MAINTENANCE DEPARTMENT
LOCKER ROOM
WAREHOUSE
PACK
MASTER
CARTON


SCREW MACHINE SECTION
TURRET LATHE SECTION
CONVEYOR #54
CONVEYOR #57
ARMATURE SHAFT MACHINING
INSPECTION
COPPER PLATE
RACK
NICKEL PLATE
ROOM
CONVEYOR #14
CONVEYOR #6
CHROME
NICKEL
ZINC
POLISHING SECTION
BARREL PLATING
WASH-SAND TUMBLE & BALL BURNISH
WAREHOUSE
PACK MASTER CARTONS
CONVEYOR # 52
CONVEYOR #51
WAREHOUSE
PORTABLE S-SHAPED TRUCK
LOAD TO TRUCK


BELT # 81
FILTER PAD
ASSEMBLY
CAROUSEL # 24
POLISHER ASSEMBLY
ONVEYOR # 10
BODY
ONDERIZING
MOVAL STATION
LACQUER
DIP
SPRAY
BAKE
ASSEMBLE
ACCESSORY CONVEYOR #4
CONVEYOR # 2
BODY SUB-ASSEMBLY
BELT # 86 DUST BAG PROCESSING
LEATHERETTE TO BODY &
LOAD TO CONVEYOR # 2
FLOOR & WALL BRUSH CAROUSEL # 22
RUG NOZZLE ASSEMBLY CAROUSELS # 25 & # 26
OTOR
EST
MOTOR RUN-IN
PILOT CONVEYOR # 11
EMPTY BODY
RACK RETURN
FRONT COVER &
FILTER HOUSING
CONVEYOR # 3
OR # 1
MOTOR & REAR END COVER
CONVEYOR # 1A
CAROUSEL # 23
CONVEYOR # 12
ROLLER
52
REAR END COVER ASSEMBLY
TEST
TEST
PACK
ROLLER # 63
LOAD FRONT RING TO # 2 CONVEYOR
BELT # 84
BELT # 85
BELT # 82
FRONT
COVER
BELT # 87
BELT # 88

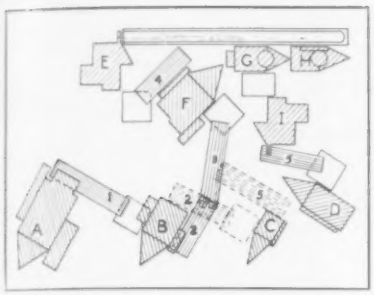


Fig. 4. Grouping of presses in "steeplechase" sequence supplemented by conveyors.

effort or a complicated sequence are unpopular and result in abnormal turnover, wide difference between theoretical and actual output and excessive rework and scrap.

4. Storage of work between operations takes up costly floor space, ties up scarce material . . . in intermediate work in process with danger of undetected errors. . . .
5. If all the operations in a sequence can be planned in reasonable balance and set up at one time, automatic inspection by the next operation frequently results, with reduced rework and scrap.
6. It is frequently possible to lay out sequences of machines to handle a number of parts bypassing one or more of the machines for some of the parts, and use portable conveyors which are rearranged quickly for each setup.
7. Use of proper conveying equipment permits utilization of the ceiling for storage where necessary, frequently at less cost and in less time than with added buildings.

SECOND FLOOR LAYOUT

(Fig. 3) illustrates motor production planning and final vacuum cleaner assembly. Assembly begins at lower middle, proceeds to right of floor plan.

So far we have seen a number of these principles exemplified in practice. Related problems of floor layout and product redesign for more economical production have been handled in accordance with these fundamentals.

The complete manufacturing picture is illustrated in terms of conveyorizing and floor layout in floor diagrams shown in Figs. 2 and 3.

First floor: Material flows into first floor production from a warehouse at left and from the warehouse shown at bottom. It is directed through metal stamping, polishing and plating to the east end of the plant (right). Die cast parts are delivered to machining section (upper right), then into further processing. Plated parts proceed to the second floor by an escalator (not shown) near conveyor 14. Bodies, after welding and Bonderizing, move by chain conveyor (upper left) to the second floor. Finished cleaners in cartons are delivered to the first floor and shipping by a gravity chute shown at lower right.

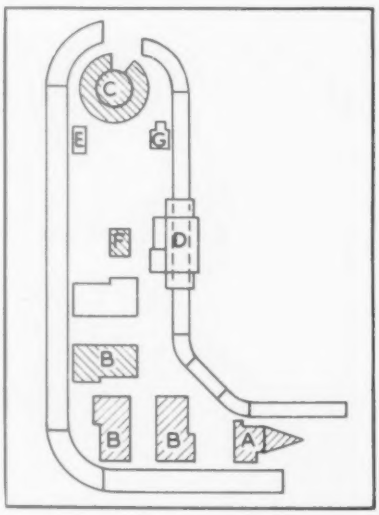
Second floor: Electrolux, which manufactures all its own motors, concentrates their production on the second floor, along with assembly of the vacuum cleaner. Motor armature and field are wound at the extreme left, then baked and finished; using a combination of roller and belt conveyors. The motor blower unit is assembled on moving carousels and belts (conveyors 20, 21 and 80). Motor is run-in and tested, then finished motor-blower unit proceeds on conveyor 1 along with assembled rear cover to the final assembly line.

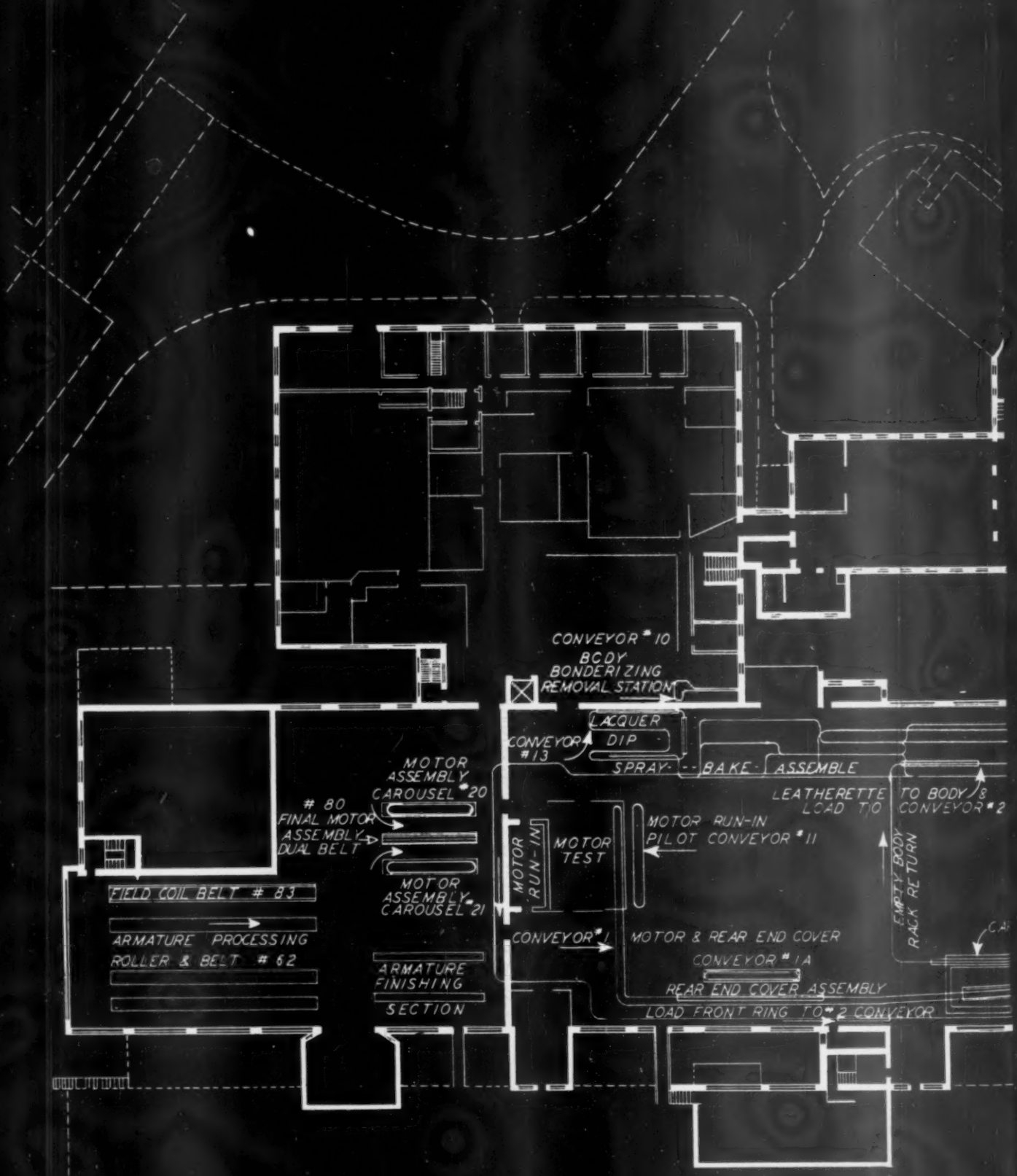
The cleaner body, which has come up from welding and Bonderizing on conveyor 10, is transferred to the lacquer dip chain and automatic spray machine, then loaded on overhead monorail carrier and sent through baking ovens. Leatherette cover is cemented here after baking, and completed body is hung on conveyor 2, a 990-ft installation which incorporates a heated section for drying the cement.

Final assembly of the cleaner begins at carousel 23 (lower middle), where the body is removed from conveyor 2, rings and sleighs are added, and sub-assembly transferred to conveyor 84. Here motor unit, rear cover, name plates and details are added and unit is delivered to the test booth. Assembly is numbered and transferred to conveyor 85, where it receives front cover and filter housing, which have been assembled at extreme right and delivered on overhead chain 3. Accessory assembly is at upper right; at lower right are conveyors for parts assembly and packing of finished units.

Assembly of the cleaner hose is an illustration of some of the inherent difficulties of multi-story operation. The only place available for quantity storage of the hose was on the first floor of a storage building which, although it was within a few feet of the final use point of the hose, required transporting on a hand truck about 400 ft through several buildings, then up on an elevator barely large enough to handle the truck, and finally another 400-ft haul on the second floor. The hose conveyor, No. 52, shown at lower right of the second floor plan, permits hose to be unloaded from storage pile and transported directly to assembly conveyor on second floor.

Fig. 5. Die-cast parts flow continuously around this loop in the machining section.




CONVEYOR # 10
BODY
BONDERIZING
REMOVAL STATION
LACQUER
DIP
SPRAY
BAKE
ASSEMBLE
CONVEYOR #13
MOTOR
ASSEMBLY
CAROUSEL #20
80
FINAL MOTOR
ASSEMBLY
DUAL BELT
LEATHERETTE
LOAD TO
TO BODY &
CONVEYOR # 2
MOTOR RUN-IN
PILOT CONVEYOR # 11
MOTOR
TEST
MOTOR
RUN-IN
EMPTY BODY
RACK RETURN
FIELD COIL BELT # 83
MOTOR
ASSEMBLY
CAROUSEL #21
ARMATURE PROCESSING
ROLLER & BELT # 62
CONVEYOR # 1
MOTOR & REAR END COVER
CONVEYOR # 1A
ARMATURE
FINISHING
SECTION
REAR END COVER ASSEMBLY
LOAD FRONT RING TO # 2 CONVEYOR

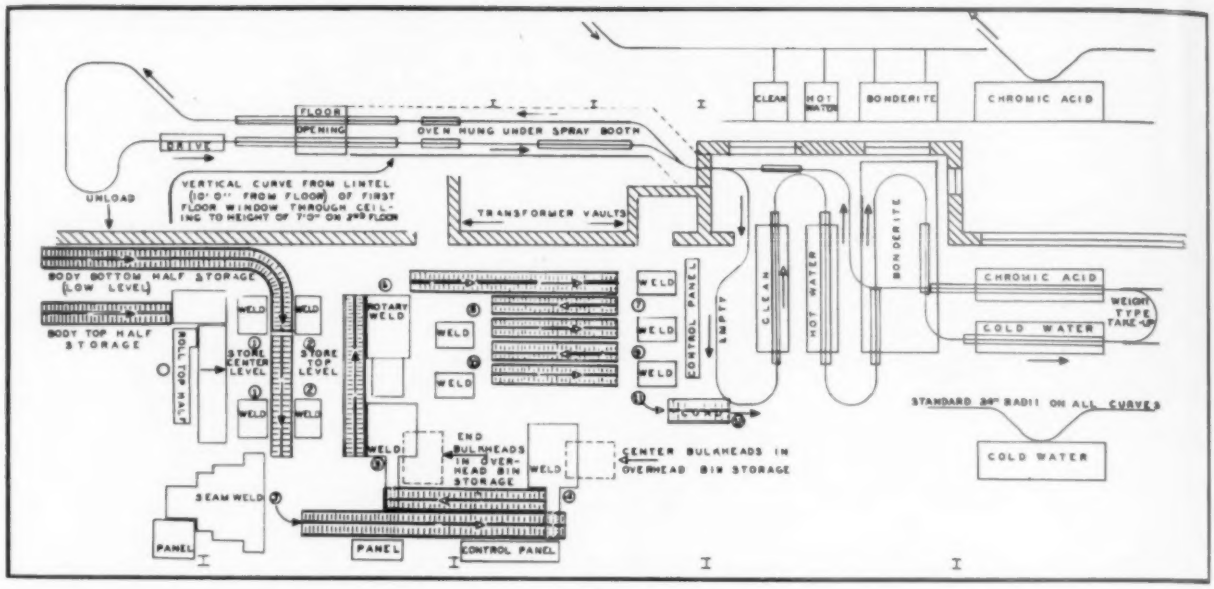


Fig. 6. Continuous flow setup for welding, Bonderizing and delivery of cleaner bodies to second floor.

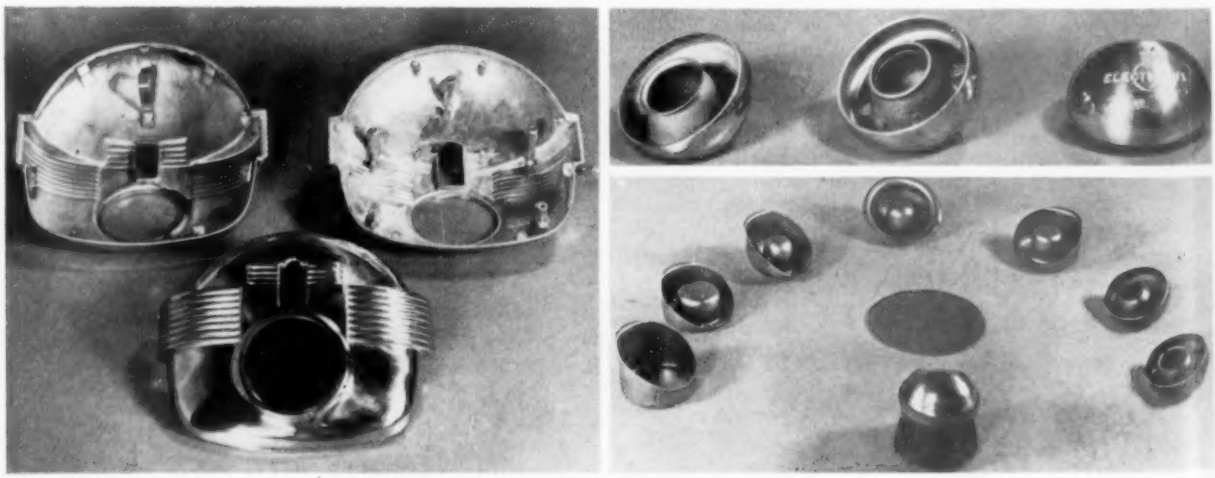
Pressroom Layout

Arthur Murray believes that "the conventional pressroom looks pretty, but oh, the backaches in handling those crates, and the confusion in moving parts around". The postwar pressroom layout at Electrolux has been on a "steeple chase" principle of continuous flow set-ups.

As indicated in the diagram of a pressroom section (Fig. 4), the steeple chase comprises a continuous grouping of presses supplemented by portable belt conveyors or Pressveyors. Handling is reduced to a minimum—crates are used only at the delivery end.

In the typical press grouping shown, dotted lines indicated how Pressveyors are shifted in changing from one part to another. For one part the press sequence is A, B, C, F, E and H. For the other it is A, B, F, G, I and D. Note that presses G, I and D are not used on one part, and that C and H are not used on the other. Bins at the side of each press provide for intermediate storage of from 800 to 1000 parts for added flexibility.

Fig. 7 (left) shows original front section of cleaner, produced as welded stamping at upper left. At right is redesigned die casting. Brush body is shown in Fig. 8, top right. At left and center are original and redesigned housings. Some draw stages of the former stamping are at bottom.



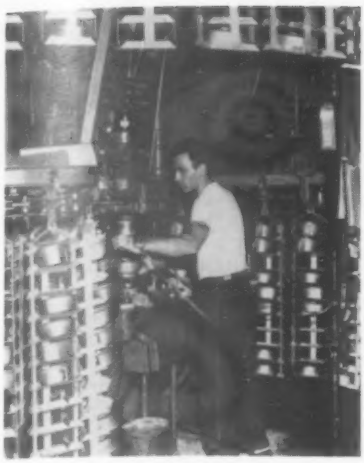


Fig. 10. Storage monorail which solves in-plant storage problems.

Machining

Greatest machining volume at Old Greenwich is in connection with the die-cast motor housing, which represents a substantial part of over 1,000,000 die castings used monthly. Parts are brought by electric truck in their original cartons to a power press indicated at A in the sketch of the machining section (Fig. 5). After a size trimming operation here, they are transferred to wire baskets and conveyed to the boring and turning machines at B.

Each of these is a two-spindle, multiple-operation machine, and arrangement is such that each operator handles at least two machines. Parts are carried by gravity conveyor to operation C, where a Kingsbury station drilling machine bores and counterbores brush-holder holes, then drills and taps a number of other holes. The return conveyor carries parts through an automatic wash at D, and then back to A, where they are replaced in the original shipper's cartons and ready for assembly.

It might be of interest to note that machines E, F and G inside the loop are drill presses which the multiple station drilling machine replaced. The drill presses are held as reserves.

Product Design Modifications

One of the tool engineer's major contributions is his tooling and production experience applied to better product design. Some examples here illustrate Electrolux's approach to cost-cutting through product design modification.

Fig. 7 shows the front cover of the Electrolux vacuum cleaner. Without changing the outside appearance from that shown at bottom, the part was changed from a welded stamping to a simple one-piece die casting. The stamping required 16 press operations on the large part, in addition to nine metal clips of five different types which were welded in five operations. Finally, a drilling operation was required.

The one-piece die casting was designed with cast-in holes for drive screws, and only buffing and polishing are required. Another example is the round brush or dusting brush body, a cleaner accessory. A top view of the part is shown at right of Fig. 8, with bottom views of the original stamped part and the die-cast redesign at left and center, respectively.

The press operations on this part were quite difficult, as can be seen from Fig. 9, and die maintenance was high. Since the shape of the design required more than half a sphere, it was originally believed that a machining operation would be required because otherwise the part could not be ejected from the mold.

A ductile alloy was found which worked successfully with the design, and the only added operation necessary is swaging the finished die casting in a punch press.

Tooling for Turkey

A concluding case history has to do with one of Arthur Murray's favorite tooling stories. Electrolux celebrates outstanding occasions, such as production records, with a free turkey dinner for employees served in the plant cafeteria. The problem of preparing some 2,000 pounds of turkey was considerable to the kitchen staff, until Murray's team went to work and came up with a redesign. They discovered that by boning the turkey before roasting, oven capacity was increased two and one-half times, and roasting time was cut fifty percent, making a gain of five to one.

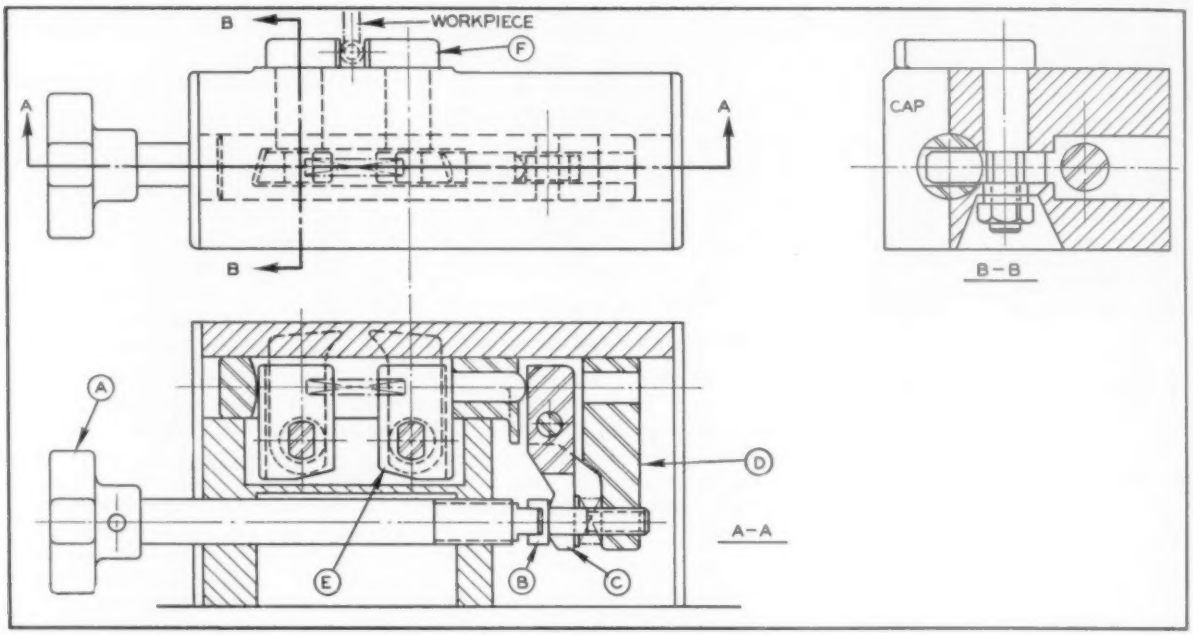
Tool Engineer Murray also boasts that both white and dark meat are uniformly tender and juicy, and that the resultant product could now be evenly sliced on the rotary slicer as opposed to slower hand carving.

Fig. 11. Looking down the final assembly line from the starting point. Note belt conveyors for assembly, as well as overhead lines for storage and parts carrying.

Gadgets

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Equalizing-Locking Clamp



The equalizing fixture shown is patly applicable to production machining of small parts.

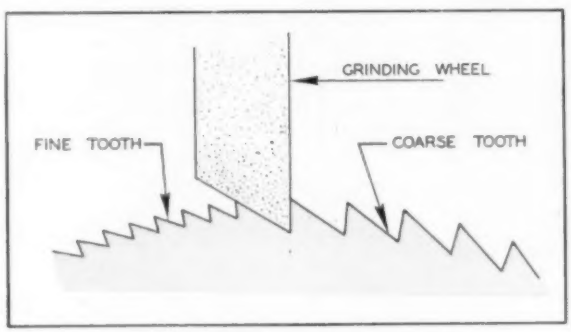
In the "gadget" here shown, equalized-locking clamp action is applied to the jaws F by turning knob A. This generates a push-pull action on cylinder D, the latter action in turn forcing levers E together. Angular faces on the latter will produce a binding action to lock the jaws F.

A sliding lug connection is required between A and B. The forked lever C, pushes a plunger that locks one lever F. The left end of the cylinder locks the opposite lever F. Springs provided on stud C, and between levers E, retract the jaws after unscrewing the knob A. The action, which may be modified to suit various types of work, is patly applicable to production machining of small parts.

John C. Grady
Northern New Jersey Chapter

Salvaging Fine-tooth Cutters

Much of the work in our plant calls for fine pitch slotting cutters of 3 to 4 in. in diameter. The fine pitch of these cutters permits only a few regrinds before the tooth pitch is so reduced as to be unable to carry the chip.



Fine-tooth slotting cutters, reground to limit of spacing, are salvaged for use as normal-pitch cutters by grinding away every alternate tooth.

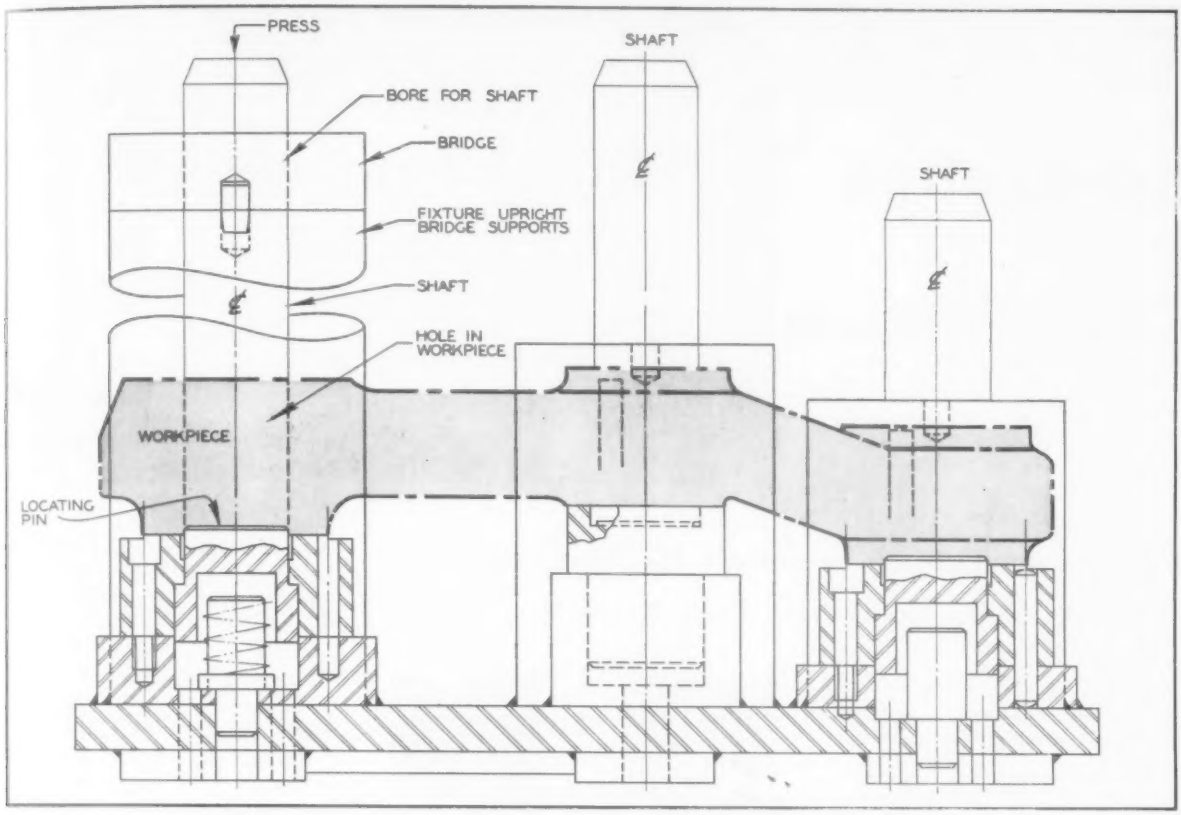
At this point, probably 95 percent of the original high-speed steel of the cutter remains. It is uneconomical to discard them, yet the time to grind off the teeth and re-tooth would be considerable.

We compromise by gashing out every alternate tooth with a fast cutting, open grained wheel, diamond trued to the appropriate tooth form. The cutters are then sharpened in the usual way and returned to service on lower grade work as normal tooth pitch cutters.

Ian J. Peacock
Carlisle, England

The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of $5.00 for each item.

Fixture for Precision Alignment of Pressed-in Shafts



A fixture, such as shown, aligns shafts, eliminates tilting or cocking and facilitates starting when pressing into a workpiece. It also insures accurate depth gaging.

A key component of a hydraulic loader requires that shafts, pressed in, be in perfect alignment. Because the shafts are ground heavy press fit, they also presented problems of straight starting until the fixture shown was devised.

The workpiece is loaded in the fixture and located by means of spring-loaded locating pins. Bridges, with bores for the shafts, are then dropped over the workpiece onto dowel holes provided on the fixture surface. This aligns the bores on the workpiece with the bores of the bridges.

The shafts are now inserted in the bridges and pressed through into the workpiece. Toward the end of the stroke, the shafts engage the spring-loaded locating pins and force them against the stop pins. At that point, proper depth of penetration is reached and pressure terminates.

H. G. Frommer
Milwaukee, Wis.

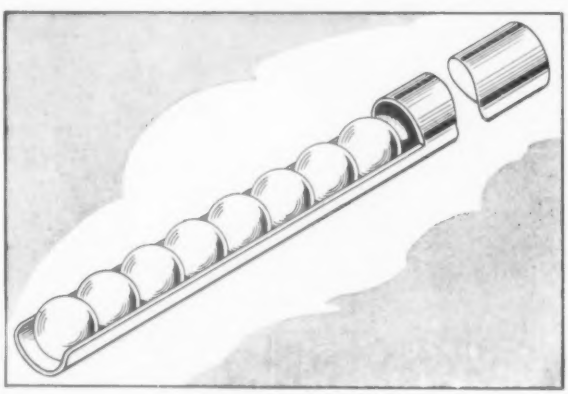
To Assemble Ball Bearings

The simple scoop here shown was made to count out eight steel balls so that they could be dropped easily into the bottom bracket bearings during bicycle assembly. By plunging the scoop into a box full of balls, the semi-circular section automatically filled with the required number.

The scoop is made from a piece of steel tube having the I. D. equal in diameter to the balls to be handled, or slightly larger. Cut away half the diameter for a length that will just hold the required number of balls and round off the leading edges of the scoop thus formed. A length of the uncut tube serves as a handle, but should be plugged so that the balls cannot roll through.

F. E. Riley
London, England

A scoop made of steel tubing, as shown, permits picking up a required number of steel balls when assembling ball bearings.



Mobilization Technical Conference Is Convention Kick-Off

A. S. T. E. NEWS
Doris B. Pratt, Editor

U. S. Ordnance Officers to Answer Members' Questions
Waindle to Moderate, at New York Know-How Forum

WHAT DOES the defense effort need from tool engineers? Does ordnance demand stricter tolerances than private industry? Different methods? Why? What are they? Are specifications arbitrary or can they be modified for economic reasons or expediency? When and how much? How does industry go about getting government contracts to replace curtailed civilian production? How adapt existing facilities? Obtain new plants? Priorities?

You can take it from here and list your own questions you'd like answered if you were to sit down with some Washington gold braid.

You'll have that opportunity on the eve of the ASTE annual meeting at New York, March 14-17. As curtain raiser for the convention, the Society has arranged a Mobilization Technical Know-How Conference in the New Yorker Hotel ballroom, Wednesday evening.

Keynoter is Lt. Gen. K. B. Wolfe,

R. F. Waindle

Lt. Gen. K. B. Wolfe

deputy chief of staff for materiel, from U. S. Air Force headquarters at Washington. General Wolfe will open the conference with an address, "Military Importance of Tool Engineering."

Others on the platform will include Col. John S. Walker, chief of the New York Army Ordnance District, Capt. C. L. Helber, supervising inspector of naval material for New York, and other military production men.

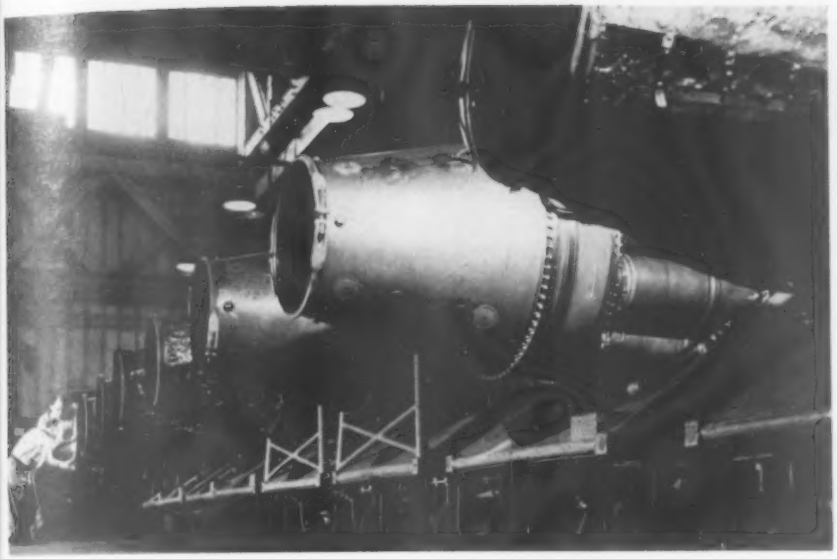
President Herbert L. Tigges and Second Vice-President H. E. Collins will represent the Society. Moderator will be Roger F. Waindle, ASTE third vice-president, who has been arranging the forum.

After General Wolfe's talk the meeting will be open for a frank two-way discussion, with the audience and the panel members exchanging questions.

These men are well acquainted with ordnance problems and requirements. In 1943 General Wolfe took over one of the most difficult engineering jobs in the Air Forces, the B-29 "super fortress." Subsequently he has shuttled back and forth between military and materiel assignments.

Mr. Tigges was recently named machine tool consultant and advisor to the National Production Authority, a function he performed in World War II. For the past two years he has directed the mobilization planning of the machine tool section of the National Security Re-

Left: An operator at Mergenthaler Linotype Co. uses a special machine to mill slots in magazine plates. Right: A trip to the United Nations Assembly is one of the highlights of the ladies' program.



sources Board. He is also active in group industrial mobilization planning.

A member of the Army Ordnance Association, Mr. Waindle was chief of tank automotive production at Chicago for the Army Service Forces from 1942-44. During the naval maneuvers in the Caribbean last March he served as official observer.

Only recently returned from a five-months' business trip and inspection of European industry, Mr. Collins is familiar with the Continent's present attitude on and ability to cooperate in the world crisis. Besides helping implement industrial output in the last world war, he taught supervisory classes under the Houston School of Technology and the War Production Board. He belongs to the Army Ordnance Association.

Industrialists to Be Guests

In addition to the discussors, major industrialists in the New York, New Jersey and southern New England areas will be invited to the ASTE forum.

The morning after this stimulating send-off the assembled tool engineers will get down to the serious business of assimilating the latest data on 34 engineering processes, methods, and materials applications.

Ever wish you had a chameleon-like material to do nearly a score of distinct jobs? Then find out "*What the Tool Engineer Should Know About Silicones*" from Ira W. Hutchison, Jr., sales development engineer for Dow Corning Corp.

As fluids, silicones are release agents for rubber and other plastics, defoaming agents, hydraulic oils, lubricants, polishes and waxes. In grease form they perform some of the same functions, along with electrical applications. The resins make protective coatings—high temperature paints, release agents where heat is an element, and electrical insulation.

Silastic, the rubber form, can be made into gaskets, wire insulation, electrical tapes and caulking pastes.

Mr. Hutchison will tell how the contradictory qualities of these materials make them suitable for applications with stiff requirements.

Has Installed Foreign Plants

After helping backward countries industrialize for peacetime production, by installing an agricultural implement plant in India, a mint in China, presses and stamping facilities for Russian tractor plants, Sergius D. Brootzkoos was instrumental in mobilizing the die and tool industry during World War II. Now he is back in Washington as mechanical engineer in the Standards Division of the General Services Administration.

He comes to the ASTE meeting to lecture on "*Optimum Use of Mechanical Presses.*" He will break down press work as to material free and material held firm during the operation. He will discuss work and pressure capacity of presses, maximum use for the required job, salient points in construction of press selected, and means for determining press capacity at the midstroke of the slide.

Mr. Brootzkoos knows industry around the world and can tell you about it in half a dozen languages.

Using multiple-cylinder construction, hydraulic presses a fraction of the size of conventional units can operate at speeds considerably above accepted practice, according to John Macewka, president of Wolverine Hydraulics Co.

Among features described in Mr. Macewka's paper, "*Multi-Cylinder Hydraulic Presses and Controls*," is the elimination of tie rods in the usual sense.

Through an automatic tie-in, the combined force of all cylinders can be applied behind the punch ram at one phase of the cycle, while at another stage two of the cylinders actuate a highly variable stripper and hold-down pad. This advantage will interest those engaged in drawing stainless.

A third subject in this field, "*Non-Concentric Automatic Transfer Press-working*," will be handled by Melvin D. Verson and Dan Verson, engineers, and E. J. O'Connell, all of Verson All-steel Press Co.

Metal Removal vs Surface Speed

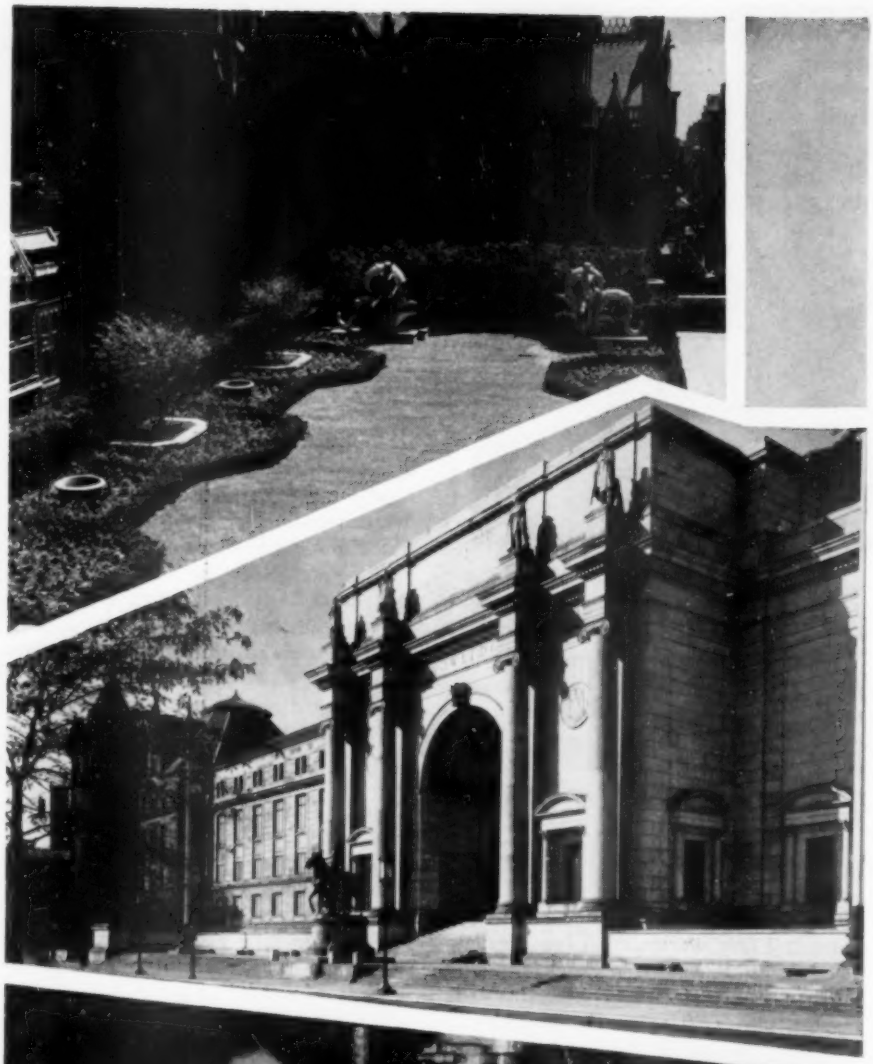
Neither red hardness nor sfpm speed ranges can be the sole basis for selecting one material over another, says Thomas Badger of the headquarters manufacturing engineering department, Westinghouse Electric Corp. and author of "*Production Evaluation of Cutting Tool Materials.*" In this paper Mr. Badger will discuss the relative positions of the four basic classes of cutting tool materials in production machining.

Amount of metal removed per minute is more closely related to the purpose of machining than is surface speed, he contends. A number of other factors enter into the proper evaluation of cutting tool materials. He will quote actual examples to prove his premise.

Long range, controlled planning is what Robert A. Winblad, head of the Milling Estimating Div., Cincinnati Milling Machine Co., will deal with in "*Criteria for Selecting Production Milling Methods.*"

Mr. Winblad defines production milling as "application of milling equipment to both long and short runs of parts to obtain high production and accuracy with interchangeability of parts at a minimum unit cost." Methods, degree of specialization, and application of automatic features all re-

Women deftly install hundreds of television chassis parts on the assembly line at Allen B. Dumont Laboratories.



solve themselves as circumstances are considered.

J. M. Delfs of the Industrial Engineering Div., Apparatus Dept., General Electric Co. will get down to specific cases in which application of "*Automatic Control of Machine Tools*" has: (a) lowered production cost; (b) increased output from available machines, or (c) made possible the manufacture of parts for which no satisfactory methods were previously available.

Which Controls and Why

He will include significant trends in automatic controls and principal fields of application, along with basic engineering and economic reasons for their use.

How current investigations in "*Measuring and Interpreting Factors in Tapping Torques*" can be applied to everyday tapping problems is what A. J. Carruthers, research engineer for Greenfield Tap & Die Co. will report. He will compare former techniques with the SR-4 strain gage dynamometer method recently developed for sensitive measuring and recording of tapping torque.

Factors affecting tapping measurements will be explained, along with a correlation of tapping torque oscillograms with photo-elastic stress patterns.

Savings in Tumble Finishing

As compared to wheel or belt finishing there are "*Economic Possibilities in Tumble Finishing*," Adolph Bregman, New York consulting engineer, has found. He will describe the latter operation from theory, through equipment, abrasives, methods, applications, limitations and costs.

Slides, to be shown by W. A. Papworth, staff engineer, Porter-Cable Machine Co., will demonstrate applications for "*High-Production Abrasive Belt Finishing.*" Mr. Papworth will outline the characteristics and behavior of abrasives mounted on belts, describe the different types of machines and their uses.

"Where production warrants," says A. C. Sanford, sales engineer, Federal Products Corp., "it is sometimes feasi-

From top: Rose window in St. Patrick's Cathedral is backdrop for this early spring roof garden in Rockefeller Center. The American Museum of Natural History on Central Park has one of the world's finest exhibits of prehistoric animals and of the development of man. Special pantograph engraving machines are used at Mergenthaler Linotype Co. to cut punches for impressing printing characters into brass matrices. A Dumont employee runs a test pattern on a big TV tube.

Arriving NEW YORK

For ASTE's 19th Annual Meeting

March 14, 15, 16, 17

And when you get in you'll want a comfortable room waiting, right at convention headquarters. The Hotel New Yorker, largest on Manhattan, will take care of our entire attendance—if they know our requirements in time.

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Executive Secretary

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Yes, that's Charlie Peterson's New Yorker Hotel orchestra. They'll play for dinner, a top-flight floor show, *and* dancing.

In between there's a fast-moving program. Our guest speaker will bring you a message keyed to the times. As a special treat the favorably-known Union Twist Drill Employees' Glee Club is coming from Athol, Mass. to sing a concert.

You'll see your new national officers sworn in, hear the president tell what ASTE is planning for you in the year ahead, what was accomplished in the year that's closing.

It's a big evening. You'll want in. Several of the largest chapters are within commuting distance, so heavy attendance is expected at the Friday evening party.

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I'm enclosing check in the amount of $..... for ..... tickets at $7.50 each for the ASTE Annual Dinner, March 16, at the New Yorker Hotel, New York City.

Meat ..... Fish ..... How many of each?

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Do not send currency. Please make checks and money orders payable to Society.

ble to design automatic gages with a 'mechanical memory,' in that a measurement can be made, held, and repeated later." This is one of the things he will take up in his paper, *"Continuous and Automatic Gaging."* In discussing case studies of programs of from $1500 to $20,000, he will cite gage tolerances of from 1/32 to one millionth of an inch at speeds up to 500 pieces per minute.

Another speaker, Edward C. Polidor, chief engineer, Engineers Specialties Div., Universal Engraving and Color Plate Co., brings up *"Inspection by Optical Projection Methods"* for tool engineers' consideration. After going into the background, principles and features of optical comparators, Mr. Polidor will show how chart gages are made, how to read the various kinds of chart lines, and types of parts lending themselves to this method.

Tool designers can benefit from *"Tooling for Multiple Slide Presses,"* as explained by W. P. Powers, secretary, and A. Melnick, chief tool engineer, U. S. Tool Co., Inc.

Offers Numerous Features

With the dozen or more features of this machine at the disposal of the tool engineer, his problem is greatly simplified, according to the speakers. Tool layout producing operations can be extended progressively. Upon arrival at the forming position, the designer may, if he wishes, produce a series of forming operations in sequence.

An internationally known author on metal working fluids has been chosen to present *"Lubricant Practice in the Forming of Metals."* E. L. H. Bastian, staff engineer, Shell Oil Co., will detail the selection and use of lubricants in specific fields such as press working, forging, extrusion. He will start with the fundamentals of lubrication, demands on and characteristics of various lubricants.

Other speakers and their papers are: H. O. Jones, welding specialist, Air Reduction Sales Co., *"Inert-Gas-Shielded Arc Welding as a Manufacturing Method"*; B. H. Marks, manager of Hydro-Finish Div. and A. L. Gardner, both of Pangborn Corp., *"Manufacturing Applications of Liquid Impact Blasting."*

Remainder of the 34 papers to be presented by 37 speakers in 28 sessions were outlined in the December and January issues of *The Tool Engineer*.

No Conflicts on Schedule

No two technical subjects in the same field are scheduled simultaneously. Visitors who want to specialize can attend all meetings on one aspect of manufacturing.

STILL OTHER IDEAS may be picked up in tours of some of the nine plants selected for their engineering interest and efficiency.

Hand lifting and transportation of television chassis and heavy components have been eliminated with completely mechanized material handling at the East Paterson, N. J. assembly plant of Allen B. Dumont Laboratories. They've even applied this principle to guest tours. Visitors are propelled through the plant on material transport trains equipped with benches and loud speakers.

Train Follows Assembly Line

You board your train at the incoming inspection department, ride past the stores area, the division where major electronic components are assembled, then to the sub-assembly section. Each train will proceed down the main assembly lines so that ASTE members may watch components being added to the bare chassis until the unit reaches the end of the line, ready for installation of the cathode-ray tube. Other departments of especial interest to tool engineers will be inspected along the way.

The Dumont assembly plant is a study in completely mechanized materials handling.

Linotype Is Die Caster

One of the earliest applications of die casting may be observed at Mergenthaler Linotype Co., Brooklyn. More than 5000 parts go into the intricate, precision machine for casting solid lines of type. Among the largest in the metropolitan area, the tool room is organized to process jigs, fixtures, dies, gages, cutters and special machine construction. One section is devoted to carbide tooling.

This plant handles both limited and mass production. Balanced and versatile tooling are necessary to process a wide variety of parts through relatively short runs. Matrix department operations are segregated because they are essentially mass production.

Punches Cut on Special Machines

Making punches for impressing printing characters into the brass matrices of the linotype machine gives this department one of its biggest tooling problems. These punches are cut on special pantograph machines with pyramidal-pointed tool steel routing tools.

Other plants to be visited were listed in the December *Tool Engineer*.

WEDNESDAY THE BOARD of directors will elect new officers while chapter delegates are electing new directors. The incoming national executives will be installed and the directors-elect will be introduced Friday evening at the banquet, gala event of the convention.

Glee Club to Sing

A top-flight floor show will entertain and the Union Twist Drill Employees' Glee Club will come down from Athol, Mass. to give a concert. This is the musical organization lauded in the press for its outstanding rendering of the Whiffenpoof Song.

The past presidents will hold their annual luncheon Friday noon. Judicial/Honor Awards Committee members of this group will continue with a meeting in the afternoon.

AND THE LADIES. They'll be busy going places. While their husbands are learning to do their part in the struggle for democracy, the women guests will board a ferry and sail out to our emblem of freedom, the Statue of Liberty. They'll go to Lake Success and hear the United Nations Assembly debate the destiny of the world. →

They'll tour Rockefeller Center—the "city within a city," watch the constellations move through the Easter heavens at Hayden Planetarium, tour the Museum of Modern Art. They'll see the world's largest department store from behind the scenes, exclaim over exclusive spring fashions displayed in expensive shops. Thursday evening they can get in some late shopping. Or choose from radio and TV shows, Greenwich Village, and other sightseeing.

Neighboring Chapters to Help

Assisting Greater New York chapter in its host duties are the Northern New Jersey, Mid-Hudson, and Philadelphia chapters. Southern New England ASTE groups will help with technical session chairmen and in organizing delegations of members.

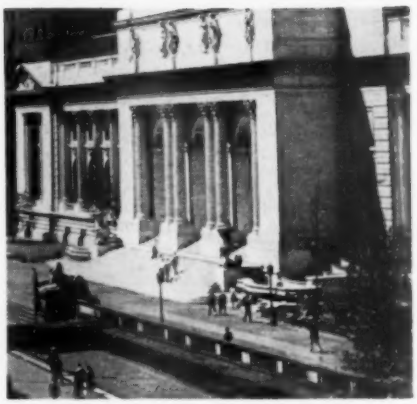
TO ACCOMMODATE early arrivals, the registration desk will open Tuesday evening. Registration fee is $1 for members, $2 for guests. It includes the entire technical program, the defense mobilization conference, and the plant tours. Tickets for the banquet are $7.50, taxes included.

The convention closes Saturday noon, in time for everybody to turn out for the big St. Patrick's Day parade down Fifth Avenue. Everybody, that is, except those lucky enough to be taking the Bermuda cruise. They're expected to be aboard the *Queen of Bermuda* at two o'clock.

FROM MAIN POINTS along its routes Capital Airlines is offering round-trip convention charter service at reduced rates. Chapter chairmen may make arrangements with the nearest company representative.

If you are entering the city by motor, write for a free copy of the Metropolitan Road Map to: New York Port Authority, 111 Eighth Ave., New York.

Before you forget it, tear out the post cards on the colored insert facing pages 62 and 65 and send in your hotel and banquet reservations.



The Public Library lions are rendezvous for thousands of hurrying Manhattanites.

Detroit Members Elected By Cutting Tool Makers

Detroit, Mich.—During its recent annual meeting the Cutting Tool Manufacturers Association re-elected Emil Gairing of Gairing Tool Co., president for a third term.

Walter Fuller of the Fuller Tool Co. was elected vice-president. R. S. Spencer of Detroit Boring Bar Co. begins his third term as treasurer.

Gordon J. Birgbauer of Super Tool Co. and K. R. Beardslee of Carboloy Co., Inc., were elected to the board of directors.

These officers and directors are all Detroit ASTE members.

Worcester Men Promoted

Athol, Mass.—C. G. Bigwood has been appointed vice-president in charge of operations, and W. A. Thorp, works manager, of L. S. Starrett Co.

Both men named in the appointments are Worcester chapter ASTE members.

Not Gloucester nor Boston, but New York where the Fulton Market fishing fleet ties up on the East River.

ASTE, ASQC Present Quality Control Panel

Hartford, Conn.—The Hartford ASTE chapter met jointly with the American Society for Quality Control, December 4, for a panel discussion on Quality Control. The meeting was held at the Hartford Gas Company Auditorium.

J. F. Greacen, chief inspector of the Bristol Co., was chairman. R. M. Toppin, factory manager of the Jacobs Mfg. Co., assisted by G. G. Kimball, head of quality control at this plant, presented an interesting problem in small lot production. With slides they showed how it had been solved by applying quality control.

Dorian Shainin of Pratt & Whitney Aircraft substituted for F. B. Murphy in the discussion panel.

After dinner speaker was C. J. Copley, editor of *Oil Power*, who talked on "Jet Propulsion and Guided Missiles."

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Chapter listings include member as well as meeting news.

Sailing... To Fun... In the Sun

This is the way the ASTE Bermuda cruise party will look on March 17 as the *Queen of Bermuda* takes them down the bay and out into the Gulf Stream. New York convention behind, seafaring adventure ahead. Nothing to worry about for five unforgettable days of luxury living, sightseeing, play, rest. It's just the breather our members need before plunging into their war tasks. (For details, see page 52, December *Tool Engineer.*)

If you've neglected making your reservation, it's possible that our New York travel consultant still can get you aboard. You can wire Leon V. Arnold, 36 Washington Square W., New York City 11, your requirements and a $50 per person deposit, and hope. Rates begin at $166.30, include room, bath and meals at sea, hotel room and meals in Bermuda, and all taxes.

Work of ASTE'ers on Display in N. Y. Plant Tours

To see how other ASTE'ers lick their tooling problems, visit some of the companies listed on the New York convention tour schedule. With two exceptions, each of these plants has Society members on its tool engineering staff, according to the extent of its tooling operations.

Even in the exceptions, assembly plants of Ford Motor Co., Edgewater, and DuMont Laboratories, East Paterson, N. J., you'll see the work of fellow members in their companies' engineering headquarters.

Largest representation is at the Eclipse Pioneer Division of Bendix Aviation Corp., Teterboro, N. J., where 38 ASTE men tool up aircraft equipment. John L. Webster, candidate for ASTE national director, is master mechanic, and Robert W. McIlwain is chief tool engineer.

Other members in their departments are: D. J. Able, J. A. Armstrong, G. L. Baker, F. A. Bourgeois, Charles Chipkin, R. M. Clark, F. J. Huss, G. J. Coupland, E. W. Cuddy, T. L. Egelson, H. J. Faerber, Peter Hofbaurer, A. S. Hylicke, Anton Item, C. R. Kopp, Anton Krause, J. G. Lang, J. C. Linn, Henry Martel, A. W. Nakonechny, E. P. Naphols, W. J. Nuss, Samuel Pagano, Herman Palmer, S. J. Petren, J. R. Russian, J. S. Shand, E. E. Snyder, William Stephenson, W. S. Stuart, D. F. Whitney, Frederick Wood, Ellis Kimons, P. S. Prasek, B. J. Savino, and Louis Schoen.

At American Machine & Foundry Co., Brooklyn, William H. Lentz, a past chairman of Greater New York chapter and divisional chairman for the convention, is sales administrator. Carl W. Johnson, who is handling arrangements for this tour, is factory manager. Other ASTE personnel are: H. N. Walden, K. R. Schikowski, Salvator Parlatore, Joseph Ostrowe, P. C. Nace, Frank Italiano, J. B. Hoglund, O. J. Fairbanks, H. J. Boll, and Max Barris.

The Propeller Division of Curtiss Wright Corp., Caldwell, N. J., includes the following members of area chapters: A. W. Bligh, H. S. Bowman, G. B. Cunningham, J. E. Epprecht, O. A. Eskuche, G. W. Fleming, F. W. Kuchta, W. D. Nagle, L. W. Stevenson, W. H. Stulen, and J. R. Krevet.

Tooling at the Wood-Ridge plant of Wright Aeronautical Corp. is carried out by: Ruben Alm, C. M. Bazaz, C. J. Bogert, Jr., D. R. Johnson, E. E. Junda, E. A. Lebeau, M. W. Schiavone, Charles Swenson, T. E. Wiberg, G. P. Hoare, and Sidney Komorowski.

H. F. Anderson, W. A. Borst, H. V. Gressang, F. J. Sandgren, W. H. Springer, J. P. Toolan, and J. R. Langworthy are with the Mergenthaler Linotype Co., Brooklyn.

Additional plants and their ASTE employees are: De Jur Amsco Corp., Long Island City: John Dokulil, E. C. Meister, and J. W. Zeiser; and Mack-International Motor Truck Corp., Plainfield, N. J.: Maxine B. Heiderich, and E. F. Bergman.

Wins Ordnance Approval Of Punched Holes

Hamilton, Ont.—December 8 meeting of Hamilton chapter featured Paul Taylor, director of the Research Div., Wales-Strippit Corp., Buffalo, N. Y. Mr. Taylor spoke to an overflow audience on a new departure in the field of metal stamping.

With slide illustrations and a comprehensive talk he showed how his company had broken down, to an appreciable degree, objections to punched holes in sheet and plate fabrication for ordnance production.

The process responsible for wider acceptance of the pierced hole lies in chamfering the end of the punch. This, Mr. Taylor claimed, improves the metallurgical qualities of the material while producing a better finished hole to closer tolerances.

These claims were verified by the projection of photo micrographs of holes parallel to within 0.5 min., size within 0.0005 in. and center distances correct within plus or minus 0.0005 in. Results were better than the punched and reamed or drilled and reamed holes previously demanded by the Navy and Air Force.

Following his address, the speaker demonstrated a metal fabricator to show the machine's versatility.

At the close of the meeting, Wales-Strippit Co. was host for a social hour.

New York Convention Program Corrections

Detroit, Mich.—ASTE national headquarters has issued three corrections in the advance program for the 19th annual meeting at New York, March 14-17. The two-color folder was recently distributed to the entire membership.

Technical Session 3, "What the Tool Engineer Should Know About Silicones," is scheduled for Parlors F and G at the New Yorker Hotel, instead of the North Ballroom as listed.

Sessions 10 through 13 will take place at 8:00 p.m., March 15, instead of 2:30 p.m.

A typographical error occurred in the name of A. P. Pfenninger, Jr., a speaker on the "Machine Tool Mounting for Vibration Dampening" symposium (Session 19).

Our Society

By H. E. Conrad

No question but what there are trying times ahead. Some of us will be called upon to make sacrifices that we never dreamed possible. In the present readjustment period, some will not fare well. For others it will be a time of seemingly high prosperity.

Don't be fooled! War or preparedness for war has never resulted in continued prosperity. Peace and peace alone can bring true prosperity. The time has come, however, when we must defend the peace we are all so profoundly seeking.

It will be easy for us to become so obsessed with our immediate problems as to lose sight of the basic concepts and true principles that we, as tool engineers, have been striving to achieve and maintain.

Must Be Independent Thinkers

Whatever we do, either as a Society or as individuals, we must never permit, or inadvertently effect, anything whereby we lose our identities as individual, free citizens with the inalienable right to think and act as we, singly, see fit. If we are going to maintain our freedom and independence as a country, we must do the same as individuals.

Getting down to specific cases as they apply to the tool engineer, the most important job ahead is to gain the recognition that tool engineering, as a profession, deserves, and the dignity and prestige that we, as individual tool engineers, are entitled to.

In our efforts to achieve these goals, many panaceas have been suggested to bring the desired results. But, as in many other problems, first things must come first. This is particularly true in the case of recognition for the Society and for the individual tool engineer.

Sell Management on Profession

A vital element in our problem is apprising top management not only of the necessity of tool engineering as a profession, but also its importance in maintaining a high level of prosperity and a high standard of living.

A major factor in winning this objective is the individual tool engineer himself. He must make himself seen and heard in the true technical conceptions for which he and his profession stand. The best way to achieve his goals is to work through his technical Society and, through this medium, make known to the world the significance of his role. This requires the concentrated effort of many. One of the quickest ways to achieve our ambition is to do everything possible to make our Society grow and prosper.

Your Society has grown through periods of depression. It has had growing pains during the time of prosperity. We have reached a point in our development where strength in numbers is essential.

Potential Is Great

Considering the number of men who make their livelihood through the various facets of the tool engineering profession, our present group is comparatively small. While this small group has done yeoman work in the past, the job that lies ahead of us is an insurmountable task for our present membership.

The future provides an opportunity for the Society to extend its services to meet the ever-growing needs of the profession and of the individual tool engineer. For the Society to reach peak efficiency however, a much broader base is required to extend its services over. To maintain a healthy operating condition, to serve industry, to build the profession and to supply the individual tool engineer's requirements, more members are essential.

Claims Nitriding Can Double Tool Life

York, Pa.—Through nitriding, the life of such tools as drills and taps has been extended as much as 100 percent, according to James J. Morrison, chief metallurgist of Landis Machine Co., Waynesboro, Pa. Mr. Morrison cited this in a talk on "Nitriding of Tool Steels" at a Central Pennsylvania chapter meeting, December 4.

The speaker described baths used for nitriding, effects of various temperatures on hardness, and differences between salt and gas nitriding baths from performance and cost standpoints.

AT PREVIOUS FALL meetings the chapter heard J. C. Wilson, chief engineer, Thompson Grinder Co., talk on "Crush Form Grinding"; G. T. Willey, vice-president of manufacturing, Glenn L. Martin Co., in an address, "Leadership in Industry," and Lloyd Raymond, chief metallurgist, Singer Mfg. Co., who lectured on the subject of "Copper Brazing."

Yuletide Parties Enliven Holiday Meeting Recess

Flint, Mich.—In the largest turnout ever attending a Saginaw Valley chapter activity, 453 members and guests enjoyed a ladies night Christmas dinner party at the Zehnder Hotel in Frankenmuth, December 9.

Following dinner numerous door prizes were distributed. The "Three Aces" entertained with record pantomines and the party continued with dancing.

DAYTON, OHIO—The annual Christmas party of Dayton chapter drew a capacity crowd of more than 200 couples to the Miami Valley Country Club, December 9.

Beginning with a pre-dinner social hour, the function continued through the evening with dancing and cards for the members and their guests.

Lawrence McAfee and his committee were in charge of the event.

PHILADELPHIA, PA.—Philadelphia ASTE'ers held their annual Christmas party at the Broadwood Hotel.

Under the direction of Chick Mallery, master of ceremonies, a five-act variety show was presented.

Approximately 385 members and guests were present. A number of door prizes were awarded.

LONG BEACH, CALIF.—On December 6 some 60 couples enjoyed dinner and dancing at Long Beach chapter's Christmas party at Vivian Laird's.

Door prizes were awarded to Mrs. C. W. Ward, Daniel Welty and L. D. Pomerantz.

Mr. and Mrs. Arthur D. Lewis and Mr. and Mrs. Anton Peck of Los Angeles were guests of the evening.

LOS ANGELES, CALIF.—The Deauville Beach Club at Santa Monica was the setting for Los Angeles chapter's holiday party, held December 15 and attended by 332 members and guests.

Dinner was followed by a floor show and dancing. Baby orchids were presented to the ladies.

Ralph Chrissie and Carl Almquist headed the affair.

MUNCIE, IND.—Dr. Tennyson Guyer, "Ohio's Ambassador of Good Will," was guest speaker at Muncie's fifth yuletide party. The tool engineers had their wives as guests for the dinner meeting at the Top Hat, December 16.

In his address Dr. Guyer pointed out that the duties of patriotism in a democracy lie with the individual.

The chapter welcomed the following

new members: Theodore A. Clark, Ralph A. Baughman, John C. Dale, Hubert D. Wilcox and Donald C. Wedlick, all of Muncie; David W. Birch of Anderson and Darrell M. Marks of Selma, Ind.

NEW HAVEN, CONN.—Past President I. F. Holland of Hartford and National Director V. H. Ericson of Worcester, Mass. were guests at New Haven's ladies night Christmas party at the New Haven Country Club, December 8. Mr. Ericson represented President H. L. Tigges who was unable to be present.

D. W. Northrop, president of Henry G. Thompson & Son Co. and of I. Newman & Son, Inc., spoke on the importance of plant tours and the benefits derived from such visits.

A social hour and dinner preceded the speaking program. Christmas gifts were presented to the ladies.

M. J. Radecki, chapter chairman, was toastmaster. More that 100 members and women guests attended the yuletide festivities.

ST. LOUIS, MO.—Santa Claus made his customary appearance at the St. Louis holiday dinner dance, presenting a gold plated travel picture frame to each of the women guests. About 160 couples were on hand for an enjoyable evening, December 15, at the Sheraton Hotel.

Strolling musicians entertained during dinner and a juggler gave an exhibition during the evening.

Holiday merrymakers dine and dance at (from top) Saginaw Valley, St. Louis, Philadelphia (around table back to front from extreme left): Walter Phifer, Joseph Jovinelli, William Clements, Eric Lund, Arthur Gebert, William Horst, Fred Goll, Winfield Thompson and William Pinkstone; and (bottom) Los Angeles chapters.

Toronto Hears Human Relations Talk—Neil Peterson of Canadian Acme Screw & Gear, Ltd. (second from left at head table) recently addressed Toronto chapter. Others at speakers table are, from left: N. E. Wearn, who introduced Mr. Peterson; John Burk, chairman; Kenneth Laidley, secretary; Clifford Farr, program chairman, and Robert Cuthbert, entertainment chairman.

Audience Discussion Climaxes Casting Talk

St. Louis, Mo.—W. O. Sweeny of the Precision Casting Sales Div. of Haynes Stellite Co. was technical speaker at the December 7 dinner meeting of St. Louis chapter.

Highlight of the program on Precision Casting was a lengthy question and answer period in which most of the audience participated. Color slides and samples contributed to the interest in this subject.

Ernest Clarke, a charter member of the chapter and originator of the Toastmasters Club in St. Louis was the coffee speaker. Mr. Clarke amused the group with a satire on a technical talk.

During the meeting there was a moment of silence in memory of the late John H. Klasey, a charter member who passed away December 5.

A DISPLAY OF VARIOUS types of gages used by St. Louis manufacturers was a feature of the previous meeting. Willis Potthoff, chapter standards chairman, conducted the exhibit. The gages were contributed by Carter Carburetor Co., Century Electric Co., Emerson Electric Co., General Metal Products and Greenlee Manufacturing Co.

C. A. Page, a Pratt & Whitney gage engineer, was the technical speaker, discussing "Modern Gaging Practice."

G. Alex Hope, president of Hope Press, Inc., gave a humorous after dinner talk.

Made Chief Engineer

Fond du Lac, Wis.—Edgar L. McFerren of Fond du Lac chapter has been promoted to chief engineer at Giddings & Lewis Machine Tool Co. Mr. McFerren succeeds K. F. Gallimore, another ASTE'er, who continues as director, vice-president, consultant.

Developers of Stainless Worked 30 Years on It

Toronto, Ont.—Three decades of tedious work had gone into the development of stainless steels before their potentialities were fully recognized in 1930.

Harold Chambers, chief service metallurgist of Atlas Steels, Ltd., sketched this background of the tough, silvery metal in introducing "Stainless Steels —Their Contribution to Progress" to Toronto members. Mr. Chambers opened the technical session at a chapter dinner meeting held December 6 at the Union Station.

Tempering to Add Properties

Roland Berkol, sales development engineer for Atlas, continued with the subject, detailing properties of these steels and specifications for various applications. Mr. Berkol charted effects of the time element in tempering stainless to produce definite characteristics.

Fred Lockhart, second vice-chairman, introduced the speakers and Douglas Cooper, first vice-chairman, thanked them on behalf of the chapter.

Prior to the talks the 120 members and guests present enjoyed a film showing production of tool steels at the Atlas plant in Welland.

John Lengbridge, education chairman, announced final plans of Hamilton chapter for a refresher course.

Fraser Joins Rem-Cru

Bridgeport, Conn.—George T. Fraser has been appointed manager of sales for Rem-Cru Titanium, Inc.

For the past 15 years Mr. Fraser has been associated with Crucible Steel Company of America, most recently as assistant manager of tool steel sales. He is affiliated with the Greater New York ASTE chapter.

Shows Sawing Techniques

Muncie, Ind.—KISMIF (keep it simple, make it fun) is the motto George Sheppard of the DoAll Co., Des Plaines, Ill., uses in working out sawing jobs. Mr. Sheppard stressed this in a talk on "Saws and Their Application in Modern Industry" given before the January 2 meeting of Muncie chapter at the Delaware Hotel.

Climax of a film demonstrating applications and adaptations was the friction sawing of hard metals.

Other points were developed in the ensuing question and answer period.

Matchett Accepts Post At Illinois Tool Works

Detroit, Mich.—Mahlon M. Matchett has been appointed sales engineer for the Illinois Tool Works, Chicago, Harold B. Smith, president, has announced. Mr. Matchett will be associated with the company's Tool and Machine Division, with headquarters at Detroit.

The Detroit ASTE member holds several patents, including one for a gear grinding chuck.

Obituary

John H. Klasey

John H. Klasey, plant engineer at Carter Carburetor Co., St. Louis, Mo., passed away December 5 in his 57th year.

Before joining Carter 27 years ago, Mr. Klasey was associated with early motor car manufacturers and with American Car & Foundry Co. The St. Louis chapter member was a native of Aurora, Ill. He received his technical training in a private course at American Wood Working & Machine Co.

Tooling Short Cuts Seen At Motor Truck Plant

Allentown, Pa.—Lehigh Valley tool engineers had the novel experience of a product demonstration on their way to the plant where it was made.

On December 15 approximately 60 members and guests climbed into a Mack bus, equipped with the latest appointments for the safety and comfort of passengers and driver.

Arriving at the plant the engineers separated into small groups and were escorted through the assembly and subassembly lines by David Evans, Andrew Moyer, Jr., Henry Mack and Charles Drumm.

Sufficient time was allowed each group to inspect and discuss the material layout, work flow, and fixtures and tools used.

Ingenious Fixtures Devised

Of particular interest were the ingenuity and imagination shown in developing and adapting fixtures to give speed and flexibility in assembling five bus models. Adjustable air clamp fixtures and quick acting clamps are widely used. Through distinctive color combinations, stops on wheel housing fixtures are easily located.

Among highlights of the tour was a "butterfly" fixture and positioner. When loaded this fixture weighs 7000 lb and can be positioned automatically or inched in by the operator.

Using stretch forms made from laminated hardwood instead of all metal, Mack saves up to $6000 per form.

Prior to the tour the ASTE party had dinner at the Masonic Temple. Eugene Pellizoni, chapter chairman, and superintendent at the Mack Mfg. Corp., introduced T. J. Zeller, factory manager, and C. E. Mintz, engineer in charge of the Bus Division.

Mr. Zeller discussed overall problems pertaining to manufacturing and bus assembly. Mr. Mintz described the tooling and setup for a bus assembly line requiring flexibility for handling different types and sizes on a production basis.

Burt Retires From P&J

Hartford, Conn.—Clayton R. Burt, former president and board chairman of Niles-Bement-Pond Co., West Hartford, Conn., recently retired from the presidency of Potter & Johnston Co., Pawtucket, R. I., an N-B-P subsidiary. He is succeeded by Frederick U. Conard, president and general manager of N-B-P.

An enthusiastic ASTE'er, Mr. Burt was recently awarded a scroll by Hartford chapter for his contributions to the progress of this group and to the national Society.

Richmond Hears Yonkers On Precision Casting

Richmond, Ind.—K. J. Yonkers of Allis-Chalmers Manufacturing Co., Milwaukee, spoke December 12 at a dinner meeting of Richmond chapter at Morton center.

Mr. Yonkers discussed "Precision Investment Casting." His talk followed a color sound picture describing the process from blueprint to finished product. A question and answer period concluded the program.

Program Chairman Dezell Gibbs introduced the speaker and out-of-town guests: Robert Loos, Keith Blackwood, Earl Taite, Carl Vail, Howard Mills, Henry Clark and Harry Hein. Two new members, Willard L. Bartlett, and Norman Brown, also were introduced.

Forty members and visitors attended the meeting. Chairman Mervin Culbertson presided and Harvey Murphey gave the invocation.

Herington Speaks at K.C.

Kansas City, Mo.—An audience of 45 Kansas City ASTE'ers and their guests attending the December 6 meeting of their chapter listened as Cecil E. Herington of Meehanite Metal Corp., New Rochelle, N. Y., explained advantages of Meehanite castings.

By following definite and established methods, foundries making these castings can obtain a superior combination of physical properties, Mr. Herington said.

Transferred to Texas

Chicago, Ill.—M. P. Lansing of the Chicago ASTE chapter now represents Morse Twist Drill & Machine Co. in Texas, the Springfield, Mass. firm has announced.

Mr. Lansing was formerly assigned to the Chicago area.

Gives Tooling Assignment In Simplification Talk

Evansville, Ind.—Herman Straus, work simplification supervisor of Servel, Inc., and a former chapter editorial and public relations chairman, spoke to his fellow tool engineers on "Training Yourselves to Design Better Production Tools," at a dinner meeting held December 11 at the Alpine House.

Mr. Straus' talk was accompanied by slides and motion pictures of a study of actual shop operations, recommendations for improvement, and the savings in time and material resulting from these changes.

Puts Audience to Work

While showing another film, Mr. Straus had the audience fill out operations charts. The findings revealed how many operator conveniences could be incorporated in a tool.

A lecturer and author on work simplification, Mr. Straus recently addressed the Industrial Management Society, as reported in *Business Week* magazine.

A. J. Stofleth, assistant cashier of the National City Bank of Evansville, spoke during the coffee period. His subject was "Printing U. S. Currency, Counterfeit and Mutilated Bills." He explained how paper for greenbacks is made and printed.

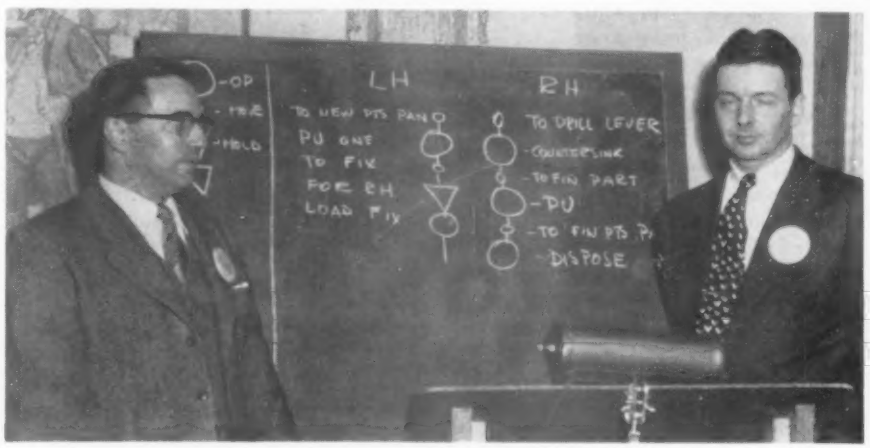
Samples of counterfeit bills loaned by the FBI were exhibited. The members plied Mr. Stofleth with questions at the close of his talk.

Manages New Office

Los Angeles, Calif.—C. W. Barnthouse, district manager, is in charge of the enlarged Los Angeles office and new warehouse of Latrobe Electric Steel Co., at 3537 E. Olympic Blvd.

Mr. Barnthouse is a member of the Los Angeles ASTE chapter.

Herman Straus (right) of Servel, Inc. illustrates tool design lecture with blackboard drawings while Charles H. Thuman, Evansville chapter program chairman and first vice-chairman, looks on.



Plant Executive Gets 310 FPM on Planing Feeds, Is Impatient With Machine Tool Manufacturers

Dover, N. H.—At least half the carbide tool manufacturers fail to utilize the advantages of this material to the fullest. Speaking before 60 members and guests of Granite State chapter, William Coomey, general superintendent of Rice Barton Corp., Worcester, Mass., also charged that machine tool builders are lagging in developing the high speed variable drives necessary to use carbides efficiently.

Mr. Coomey was the technical speaker at the December 12 chapter dinner meeting. His subject was "Carbide Tool Applications in Turning, Planing and Milling Operations."

Speaking at Granite State chapter, William Coomey of Rice Barton Corp. demonstrates on blackboard as he describes radical departures in getting maximum from carbides.

The speaker went on to point out radical departures from long standing techniques, to get the maximum benefit from carbides. He revealed instances of planing feeds of 310 fpm on mild steel as compared with the conventional practice of 175 fpm.

While conducting a business meeting prior to the technical session, John Woodman, chapter chairman, announced the gift of a gavel from Everett Leavitt of Essex Tool & Die Co. Mr. Woodman also introduced Richard Wiley of General Electric Co., who had volunteered to be official chapter photographer.

John Kenney, membership chairman, presented a plan for expansion in 1951. Between October 2 and December 12, 1950, he reported, membership had jumped from 59 in 10 companies to 68 from 14 firms.

At this time Mr. Kenney introduced the "memberometer," designed to serve as a visual indication of chapter growth. Goal for October 1, 1951 is 150 members representing 40 companies. This, he added, would put the chapter in 39th place nationally.

George Mucher of Clarostat Mfg. Co. won a complimentary dinner ticket for the second successive time.

V. H. Ericson, national director from Worcester, Mass., was introduced and commented briefly on national headquarters and Society activities.

Before introducing the speaker, Paul Deschenes, program chairman, told what his committee is doing to improve program announcements and in lining up future programs.

Guests were introduced from the following firms: Kidder Press, and Clarostat Mfg. Co., Dover; U. S. Naval Shipyard, Portsmouth; National Needle Co., Hill, N. H., and Essex Tool and Die Co., Newburyport, Mass.

Simon Heads Indianapolis Nominating Committee

Indianapolis, Ind.—Robert Simon was elected chairman of the Nominating Committee at the January 4 meeting of Indianapolis chapter in the Athenaeum. Serving with Mr. Simon are H. D. Hiatt and H. W. Curfman.

Following the business meeting Chairman Reinhold F. Krause introduced the technical speaker, F. J. Henkel, president of Lamina Dies & Tools, Inc., Berkley, Mich. Mr. Henkel discussed "Increased Die Life Through Proper Grinding Procedure."

Tool failures, he has found, are usually caused by heat generated in grinding punches and dies. He advocates using a coarse grit, medium soft wheel at low speed. Making only one pass of the diamond when finish dressing the wheel, and taking a shallow cut, also contribute to cooler grinding temperatures, he said.

These procedures will result in more pieces per grind through eliminating surface strains, Mr. Henkel claims.

Dinner was served to 70 men before the meeting. Other members joined the group for the technical program.

Society Issues Analysis Of 1950 Exposition

Detroit, Mich.—A statistical analysis of the 1950 Tool Engineers Cost-Cutting Exposition has been issued by the Society. The eight-page booklet reports studies made by ASTE and by an independent researcher.

A lecturer in marketing at the University of Pennsylvania's Wharton School of Finance made the independent study by personal interview for a master's thesis. It translates visitors' attitudes and motivations into a dollar potential for show exhibitors.

In addition, the breakdowns in the booklet offer valuable information to anyone with an industrial selling problem. Copies are available on request from: American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21.

Advocates Climb Milling With Carbide Cutters

Rochester, N. Y.—Approximately 75 members and guests of Rochester chapter gathered at Rochester Institute of Technology, December 4, to hear J. R. Miller of Beaver Tool & Engineering Co. discuss "Practical Application of Carbide Milling Cutters." Vice-chairman James O. Horne introduced the speaker.

Mr. Miller first explained and sketched the principal angles used on a face milling cutter. Problems dealing with design, sharpening procedures, maintenance problems and application of carbide milling cutters were approached in non-technical language. This was especially appreciated by men responsible for supervising and actually putting into operation carbide milling cutters.

The speaker recommended climb milling wherever possible, use of fly wheels, and regulating depth of cut to suit hp of machine. He also gave his opinions of proper procedures for clearance angles, rake angles, feeds and speeds, and other factors.

James O. Horne, first vice-chairman of Rochester chapter, greets Technical Speaker J. R. Miller of Beaver Tool & Engineering Co.

Chairman Emmett Moore was moderator for the discussion period. He complimented Mr. Miller on his talk and the amount of comment evoked in the group discussion.

Burleigh Made Manager

Barberton, Ohio—Appointment of Don Burleigh as manager of the Machine and Foundry Unit of The Diamond Match Co. has been announced by Walter O. Augustine, vice-president.

Mr. Burleigh, an Akron chapter ASTE'er, has been acting manager of the Barberton unit.

Scores Government Policy In Engineering Setup

Washington, D. C.—An engineer who helped pioneer methods-time measurement vigorously attacked the separation of process engineering and tool engineering as practiced in the government, while addressing the December 7 meeting of Potomac chapter at the Dodge Hotel.

J. L. Schwab, divisional manager, Methods Engineering Council, Bridgeport, Conn., denounced this policy in a talk stressing the importance of proper planning for production.

The tool engineer, said Mr. Schwab, must evaluate the time element and combine that factor in his design of equipment used on the job. He is the most qualified person to render estimates and can utilize the time-methods yardstick to reduce discrepancies to the minimum.

Analyze Each Motion

The speaker was particularly emphatic on breaking a job down into individual motions before initiating production. While conceding that alterations and improvements are sometimes necessary, proper consideration of motion details beforehand would do much to eliminate these needs, he declared.

H. L. Tigges, Society president, was a guest at the meeting, and spoke briefly on the importance of the tool engineer in today's economy. He ventured the opinion that the future would find the tool engineer playing a still greater role in industrial accomplishment. Outlining the growth of the Society, he cited recent achievements as particular indications of success.

SPRINGFIELD, VT.—On December 13 Mr. Schwab spoke to 75 members and guests of Twin States chapter in a dinner meeting at Trade Winds Cafe. His subject for this appearance was "The Next Ten Years of Tool Engineering."

While predicting qualifications to be required of the tool engineer in the future, Mr. Schwab laid down four fundamental specifications to which scientific measurement data must conform: easy to understand, quick to apply, consistent over the entire range of the data coverage, and reproducible.

Chairman Hinckley Ranney presided over a business meeting and introduced five new members to the group. Program Chairman Floyd McArthur introduced the guest speaker.

Precise Appoints Hilbert

Rochester, N. Y.—Ray F. Hilbert has been appointed manufacturer's representative for Precise Products Co. Mr. Hilbert will represent the Racine, Wis. firm in the state of New York.

Prominent at December meeting of Potomac chapter were, from left: E. M. Seifert, former director; H. L. Tigges, Society president; H. B. McLeod, chairman; J. L. Schwab (technical speaker) of Methods Engineering Council, and G. M. Beck of the U. S. Naval Gun Factory.

Saginaw Valley Makes Awards to G.M. Students Other Chapters Offer Lectures, Prizes, Scholarships

Flint, Mich.—Saginaw Valley chapter made its fourth annual student awards during an educational night dinner held January 18 at General Motors Institute.

For writing the best fifth year project on a tool engineering subject, Frank Faga, institute student cooperating at Fisher Body Div., Flint Plant No. 1, received a year's membership in the chapter, an ASTE emblem, and complimentary dinner tickets for the year.

Three high ranking juniors cooperating in local plants qualified for awards of chapter membership during their senior year. They are: Robert Cindric, A. C. Spark Plug Div., Flint; Phillip Passon and Robert Bowen, Chevrolet-Saginaw Transmission.

Gilbert Presents Awards

The awards were presented by Prof. William Gilbert of the University of Michigan, a member of the ASTE National Education Committee.

Guy R. Cowing, president of the institute, spoke on "General Motors Institute, a Tool."

Following Mr. Cowing's talk, the group made a tour of the institute, including the laboratory where such units as a drill dynamometer, sonigage, spectrometer, metallograph, and gas analyzer were in operation. A film on the Allison jet engine was shown.

BOSTON, MASS.—At Massachusetts Institute of Technology in Cambridge, Boston chapter is sponsoring its fifth annual educational lecture series.

On February 15 there is a panel discussion of "Methods of Small Lot Production." Speakers and their subjects are: Harry W. Rowley, planning engineer, Motor Div., General Electric Co., "Planning Methods"; Cecil A. Lockwood, equipment engineer, United Shoe Machinery Corp., Beverly, "Equipment Selection," and John W. Geddes, chief engineer, H. K. Porter, Inc., Somerville, "Standardized Procedure."

"The Quarterback in Industry," an educational film, will be shown on March 1.

The series began January 18 with a session on "Product Analysis and Manufacturing Efficiency" by Alex Strong, industrial engineer, Rath & Strong, Boston.

"Precision Inspection Equipment" was the January 25 lecture, presented by a Mr. Gourlie, gage standards engineer of Sheffield Corp., Dayton, Ohio. Mr. Gourlie was assisted by John Merryman, Boston representative.

P. M. McKenna, president, Kennametal, Inc., Latrobe, Pa., spoke February 1 on "Use of Carbides."

The meetings are held in Room 3-270 at 7:30 p.m., under the direction of Frank Leonard, education chairman.

YORK, PA.—Central Pennsylvania chapter is offering three ASTE Handbooks and student memberships to top students at the York, Hanover, and Lancaster, Pa. senior high schools.

A merit point system is used to determine the winners. Each student is evaluated by his teacher, with the chapter Education Committee acting as advisor and auditor.

Purpose of the award, says C. F. Stephenson, education chairman, is to help worthy students and "get potentially better professional material interested in ASTE as future senior members."

NEW HAVEN, CONN.—Students in tool engineering may compete for an ASTE prize of $25 at the end of their junior year.

Henry Keshian, education chairman, has announced this award to be given by New Haven chapter.

For the past two years the chapter has also sponsored a three-lecture fall course in Fundamentals of Tool Design at Yale University.

Coming MEETINGS

ALL CHAPTERS—February. Election of chapter officers, delegates and alternates. March. Installation of officers.

(BRIDGEPORT, CONN.) FAIRFIELD—March 7, Stratford Hotel. Speaker: W. L. Hardy, Norton Co. Subject: "Tool and Production Grinding." H. E. Conrad, ASTE executive secretary, will be guest.

CENTRAL PENNSYLVANIA—March 5. Speaker: N. M. Perris, management engineer, Stevenson, Jordan & Harrison, Inc. Subject: "Manufacturing Control."

CHICAGO—February 13, 8:00 p.m., Western Society of Engineers. Speaker from Argonne National Laboratory, Lemont, Ill. Subject: "Atomic Energy and the Tool Engineer." March 17-21, 1952, Tool Engineers Industrial Exposition.

CLEVELAND—February 14, Tudor Arms Hotel. Dinner 6:30 p.m., technical session 8:00 p.m. Speaker: P. M. McKenna, Kennametal, Inc. Subject: "Single and Multiple Point Mechanically Held Carbide Inserts." March 14. Speaker: Harry Hyrider, The Vascoloy Ramet Corp. Subject: "Tungsten Carbide and Cast Alloy Wear Parts."

COLUMBUS—February 14. Speaker: Dr. P. W. Fitts, professor of psychology, Ohio State University. Subject: "Designing Tools and Indicators for Efficient Human Use."

DETROIT—March 1, Junior Room, Engineering Society of Detroit. Carbide Series. Subject: "Precision Boring and Reaming." March 8, Engineering Society. Ladies Night.
Student section meeting: March 15, 7:30 p.m., Junior Room. Subject: "Alloy Steel."

EVANSVILLE—February 12, Alpine House. Speaker: E. J. Vanderploeg, assistant chief engineer. The Yoder Co., Cleveland. Subject: "Possibilities and Limitations of Cold Roll Forming."

(FLINT) SAGINAW VALLEY—February 15. Subject: "Quality Control." March 15. Past Chairman's Night.

HARTFORD—February 19. Subject: "Estimating and Management Engineering." March 5. Joint meeting with Society of Carbide Engineers.

NORTH TEXAS—March 9. Speaker: Dr. H. B. Osborn, Jr., Tocco Div., Ohio Crankshaft Co.

(NEWARK) NORTHERN NEW JERSEY—February 13, Robert Treat Hotel. Closed meeting. March 13. Executives Night dedicated to Hyatt Roller Bearing Co. Speaker from Hyatt.

NEW HAVEN—March 8. Subject: "Moulding Plastics."

NEW YORK, GREATER—March 14-17, Hotel New Yorker. Nineteenth Annual Meeting, ASTE. March 14, house of delegates and board of directors meet. March 17-22. Post-convention cruise to Bermuda on *Queen of Bermuda*. Stay at Princess Hotel, Hamilton, Bermuda.

PHILADELPHIA—February 15, Engineers Club. I.T.E. Nite. March 15. Gear Finishing Symposium.

(SPRINGFIELD, VT.) TWIN STATES—February 14. Speaker: A. O. Schmidt, Kearney & Trecker Corp. Subject: "Milling by Modern Techniques." March 14. Speaker: Guy Hubbard, machine tool editor of *Steel*. Subject: "History of Machine Tool Industry."

TORONTO—March 7, Oak Room, Union Station. Dinner, 6:30 p.m. Speaker: Edward Barker, Modern Tool Works, Ltd. Subject: "Duplicating Technique."

(WASHINGTON, D. C.) POTOMAC—March 8, Dodge Hotel. Speaker: B. A. Taylor, vice-president, Chrome Electro-Forming Co., Detroit. Subject: "Hard Chrome Plating to Size."

WORCESTER—March 6. Visitation, Uxbridge Worsted Mills, Uxbridge, Mass. Dinner at Uxbridge Inn.

Positions Available

EXPERIENCED SCREW MACHINE OPERATORS for Davenport, Brown & Sharpe, and Acme Gridley machines. Apply Weatherhead Co. of Canada, Ltd., St. Thomas, Ont.

McBride to Head ASTE Activity at Campus Show

Lawrence, Kans.—The University of Kansas ASTE student chapter met December 13 at the Fowler Shops on the campus.

Harold Buddenbohm, chairman, opened the meeting and headed a discussion of the group's participation in the annual engineering exposition to be held at the university in April. Dale McBride was appointed chairman of this activity.

Howard Lebo, chairman of the parent chapter at Kansas City, Mo., reported on expected job opportunities from local firms for the coming year.

Speaker of the evening was Robert T. Howard, chief metallurgist for Black, Sivalls & Bryson, Inc., of Kansas City, Mo., who spoke on "Safety Head, Protection for Industry."

Discs Prevent Explosions

Mr. Howard's speech was a technical discussion of the aluminum safety disc used by industry to prevent explosions in pressure lines if the usual safety valve should fail. Mr. Howard demonstrated the discs and showed slides of accidents which could have been avoided by using these devices.

LEROY E. CAMPBELL, production engineer for the Benson Manufacturing Co. of Kansas City, Mo., addressed the previous meeting. Mr. Campbell commented on a short Benson film depicting mass production of aluminum beer barrels. He also talked on his recent tour of European industry. Color slides made in Switzerland illustrated this portion of his program.

Refreshments were served at the close of both meetings.

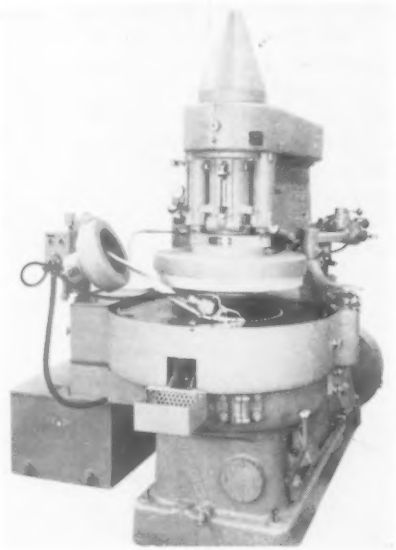
Made Your Reservation For the New York Convention?

Women Garner Windfall—Dollar coins clink into glasses as Director T. J. Donovan, Jr. of Philadelphia makes surprise awards to holders of tall, slim tumblers at Greater New York chapter's ladies night. (Story in January issue of *The Tool Engineer*.)

Tools of Today. . . .

Hyprolap by Norton

Norton Company, Worcester 6, Mass., announces the improved No. 6 Hyprolap vertical lapping machine which, now made adaptable for the finishing of small flat parts continuously, opens greater field for the machine as a high production tool.



The design offers benefits of automatic loading and unloading during the lapping cycle; continuous lapping with no down time except for dressing laps; high production with no sacrifice in accuracy or finish; and handling time reduced to a minimum. Furthermore, the operator can be unskilled, an automatic safety device stopping the machine in event of improper loading.

As stated by the maker, the machine is not intended to take the place of all lapping equipment; rather, it should be considered mainly for high production requirements such as production lapping of small flat parts that offer no unusual problems in the way of rapid loading.

The machine illustrated is arranged for continuous or through feed lapping of small brass washers. A drumtype hopper selects and positions the parts, those out of position being automatically rejected and returned to the hopper. When loaded, the washers pass from the outer edge of the lap to the inner, then out again to drop into a discharge chute. The out-in-out path of the work is consistent with good lapping practice and, providing even lap wear, reduces lap dressing. **T-2-751**

Automatic Driller

An automatic drilling machine, designed to drill and c'sink cotter pin holes in clevis pins, is announced by the Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich. The machine incorporates four Model KH G-N automatic drilling units which operate in conjunction with a completely interlocked Geneva type, 8-station indexing dial and an automatic hopper feed.

The part is countersunk on one side at the first unit, drilled in two passes at the next two stations to reduce drilling time, and countersunk on the opposite side at the fourth station, all at a stated production rate of 1500 pieces per hour.

The machine is designed to stop automatically should a tool break or a malformed part jam the mechanism. **T-2-752**

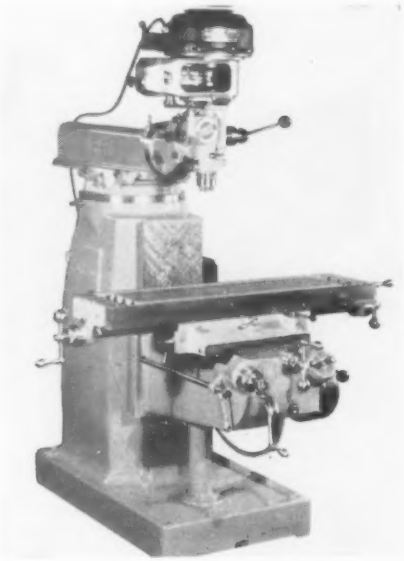
Coolant Spouts

J. N. Fauver Co. Inc., 49 W. Hancock St., Detroit 1, Mich., announces a line of coolant spouts—the Bullseye—claimed to "stay put" without any support and regardless of machine vibration, and to be completely leakproof and adjustable to any machine tool.

Features include: elimination of all leaky pipe joints and swivels; unrestricted flow of coolant, allowing lower controlled pressure with reduction of splatter and coolant waste; a clear, unobstructed view of the work; and ease of switching from one machine to another. They are smooth and offer no hazard to operators' hands. **T-2-753**

Vertical Miller

The Tree Tool and Die Works, Racine, Wis., announces limited production on their No. 2 UV Universal Vertical Milling Machine. A quality tool built for range and versatility, it combines the weight and rigidity of a No. 2 size miller with the flexibility of a universal head designed for all angle milling, drilling and boring.



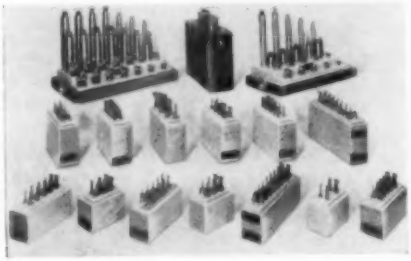
The universal head, mounted on a ram which permits moving the spindle to any position perpendicular to the table, may be tilted 45 deg from vertical and is further rotable 90 deg parallel with the table. Spindle speed range is 140 to 3500 rpm or 210 to 5200 rpm. Other head details include power driven feed to the quill, enclosed micrometer depth stop, and a positive quill lock.

Among other features is an automatic collet closing mechanism said to have unusual gripping power for holding tools without slippage. Capacity ranges from $\frac{1}{8}$ to $1\frac{1}{2}$ in. end mills. Striking features of construction include a heavy 45 deg dovetailed column and extended knee construction. Complete specifications are available from the manufacturer. **T-2-754**

USE READER SERVICE CARD ON PAGE 89 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Grouped Boring Tools

To facilitate jig boring, Bokum Tool Co., Detroit 21, Mich., now offers grouped sets of their boring tools to meet varying requirements. These sets provide each operator, in convenient, compact form, an assortment of boring tools of only those shank diameters and lengths normally required to carry on his particular type of work.



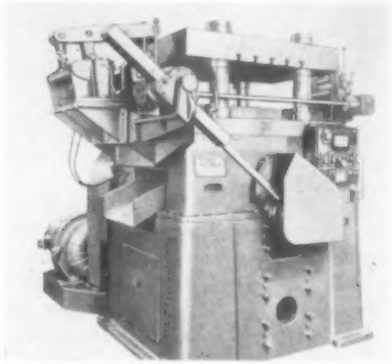
Made up into sixteen different combinations of boring tools as a result of an extended survey, these sets should satisfy practically every requirement in any shop, not only with respect to diameters of holes—which may run as small as 1/16 in.—but depths of holes as well. The larger diameter tools have separate cutters, all interchangeable to fit the shanks supplied. In some cases two shanks for each tool size are included: a short stubby standard, and an extra long.

All sets are housed in compact wooden cases, some containing 3/4 and 1 in. adapters to fit tools with 3/8 in. shank diameter to provide a range of smallest boring diameters. A folder, giving the contents of each set is available on request. Bokum also offers a specially designed resharpening fixture designed to maintain these tools in A-1 condition.

T-2-761

Automatic Presses

A complete line of wide bed Automatic Presses, ranging in size from 30 tons to 2,500 tons, has been announced by the Brandes Press Co. The press illustrated is a 175-ton wide bed model built to J.I.C. standards including T-slots in the top platen and complete remoted control of the variable speed drive. This press features a die clearance of 28 in. from front to back by 60 in. from right to left. The roll feeds have a 3 in. vertical adjustment and will take material up to 18 in. in width. The scrap cutter has a 1 in. horizontal adjustment, and pitch adjustment of the roll feeds range from 0 to 12 in.



This 175-ton press will take strokes up to 10 in., with speed of up to 250 strokes per minute obtainable, depending on length of stroke. One feature, common to all Brandes machines, is that no moving parts or projections are built below the base of the press. Reciprocating parts are air counterbalanced and incorporate long multiple guides to give an even pulling action to the top platen.

A remote push-button control panel, which gives the operator complete control of the press, contains a master stop button, electric tachometer graduated into strokes per minute, inching button, run button, forward and reverse button for the motor drive, and a manually operated rheostat for speed control. Further information may be had by writing the company at 6408 Euclid Avenue, Cleveland 13, Ohio, Dept. R.

T-2-762

"MARVEL" HAS always had the edge

MARVEL High-Speed-Edge Blades assure **Faster,** more Accurate cutting with proven Economy **and** complete Safety. Only the MARVEL is a composite blade with a high speed steel cutting edge electrically welded to an exceptionally tough, strong alloy steel body.

The High-Speed-Edge does the cutting while the alloy back with hardened eyes, carries the load. Blade tensions up to 300% higher than those possible with ordinary blades are recommended. This greater tension is confined to the cutting or leading edge by the location of pin holes (exclusive MARVEL design feature) and cannot be overcome by work resistance. Heavier feeds and greater speeds are practical without "run out."

With greater accuracy, higher production and lower cost per cut, come the extra dividend of Safety, for MARVEL High-Speed-Edge Hack Saw Blades are Positively Unbreakable—*they will not shatter.*

Ask your local MARVEL distributor (see classified phone book) to help you modernize your metal sawing with MARVEL High-Speed-Edge Blades. They cost no more than ordinary blades.

1. High-speed-steel cutting edge.

2. Tough unbreakable alloy steel body with hardened eyes.

1. & 2. Integrally welded to make a fast-cutting, long lasting composite blade that is *positively unbreakable.*

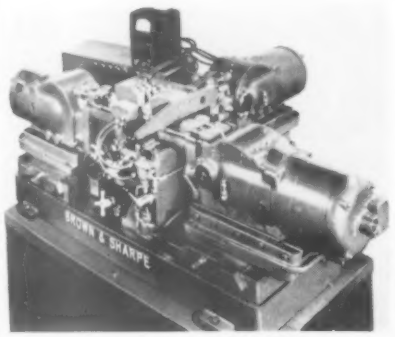
MARVEL *Metal Cutting* SAWS
Better Machines—Better Blades
ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"
5700 Bloomingdale Ave. Chicago 39, U.S.A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-76

Jet Blade Machine

For accurate machining of aircraft jet engine blades, the Brown & Sharpe Mfg. Co., Providence 1, R.I., has developed a machine for positioning the blade and drilling the center holes used for locating purposes in a subsequent operation on the holding surfaces.

The blade is supported in a non-frictional, vertically adjustable reed-mounted cradle arranged to adjustably pivot about two axes. Either of the three movements can be clamped independently without affecting the others. Proper positioning is effected by observation of six strain gage indicator points, in contact with the airfoil surface, and adjusting the three movements to the "zero" position. Indication is obtained from a B & S electronic amplifier.



A multiple position switch permits selection of individual gage indication for setup purposes. Additional switch positions cause all gages to be interconnected electrically to show individual average indications for the three movements required to bring the airfoil surface to a position which is least conducive to errors of twist or bend in the blades.

After positioning the blade, a switch is operated to cause advance of three combination center drill and facing cutters which make three operations on bosses on the blade. The machine setup is accomplished from a master blade. The machine accommodates seventeen sizes of blades. The manufacturer estimates that one man can operate the machine at a rate of 100 blades per hour. **T-2-771**

Split Washers

"Sabeco" split thrust washers, by the Saginaw Bearing Co., 821 So. Water St., Saginaw, Mich., are designed to facilitate repair of industrial equipment. To install, it is not necessary to dismantle a machine; instead, the worn or damaged thrust bearing is split and removed and replaced with the split bearings, which locks with a safety key. The bearings are made of a low-friction metal for extended wear. **T-2-772**

Wire Drive Unit

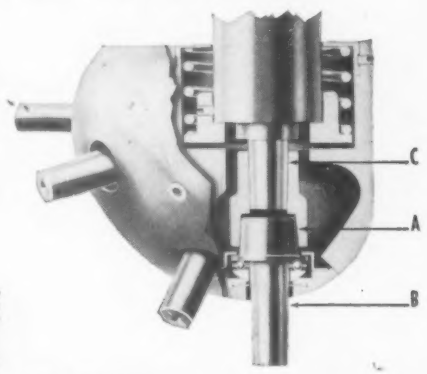
Announced by the Linde Air Products Co., 30 E. 42nd St., New York 17, N.Y., is a hand torch and automatic wire drive unit designed to permit faster welding than has previously been possible with hand welding equipment. The consumable electrode serves as filler metal, the welding rod being fed from a coil into an argon-protected atmosphere at a steady, predetermined rate.

The unit, which consists of the Linde FSH-4 argon metal arc hand welding torch and the FSM-2 rod feed unit, is said to be particularly adaptable for welding aluminum in thickness ranges from ⅛ to 1½ in. Hand welding can be applied on butt, lap, fillet, edge and corner joints in the overhead, and vertical as well as in the horizontal and flat positions.

Operation is automatic, with rod feed, argon flow and cooling water automatically controlled. An electronic governor provides accurate and uniform control of rod feed rate. Complete information on this interesting development may be had from the nearest Linde office, or from the general offices as per address above. **T-2-773**

MORE HOLES
PER HOUR — PER DOLLAR

Increase production of any standard drilling machine by adding a Lign-o-matic, the *only* drill turret with the patented, self-centering principle that guarantees sustained accuracy equal to the drilling machine itself.



FOR ALL CONSECUTIVE DRILL PRESS OPERATIONS

PROVED PRODUCTION INCREASE — Turret indexes faster than tools can be changed or work moved to another spindle. A single Lign-o-matic will release 5 drilling machines for other work and still show increased production and reduced costs on original job.

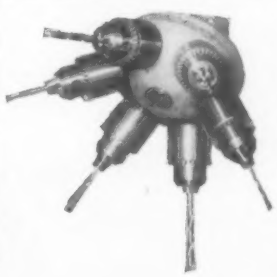
VERSATILITY— Fits any standard drilling machine without altering the machine. Handles operations such as drilling, reaming, counterboring, and tapping (on reversible spindle machines), up to ½" diameter in any material.

PRECISION — Patented, self-centering tapered drive (A) automatically locks turret spindle (B) into exact alignment with drilling machine spindle (C) for sustained accuracy.

GUARANTEE — May be returned in 10 days *for any reason* for full refund of purchase price. Two-year guarantee against defective parts.

PRICE — Model D, 6 spindles with No. 2 Jacobs male taper $235.00
Chucks extra at established prices.

DELIVERY — Currently, 2 weeks.



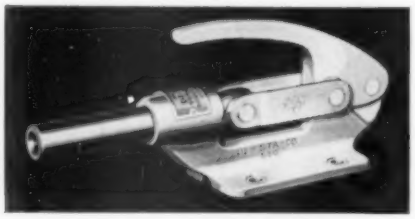
☐ Please rush ..... Lign-o-matic turrets for
(drill press make)..... (size).....
(quill dia.)..... (spindle taper).....
My name.....
Title.....
☐ Please send literature on Lign-o-matic turret.
(Attach coupon to company letterhead)

HOWE & FANT, INC.
530 FLAXHILL RD., SO. NORWALK, CONN.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-77

Toggle Clamp

A powerful heavy-duty, plunger-type Toggle Clamp—De-Sta-Co No. 650—has been added to the line of production tools by Detroit Stamping Co., 328 Midland Ave., Detroit 3, Mich. This clamp positions and holds work with a toggle locking action said to deliver holding pressures up to 4000 lbs.



Base and plunger housing, and the handle, are each a one-piece high-alloy heat-treated steel casting. The plunger, tapped for a ⅝ in. adjustment bolt, travels 3 in. and is lubricated by a self feeding pad on top of the housing. Overall dimensions are 3 x 4½ x 11¼ in., width, height and length respectively. The tool weighs 5 lbs. 10 oz.

T-2-781

MILNE'S COMPLETE LINE OF HOLLOW AND SOLID TOOL STEELS HAVE OVERALL COLOR IDENTIFICATION THAT SIMPLIFIES INVENTORY CONTROL

MILNE'S TOOL STEELS ARE "UNFORGETABLE" BECAUSE THEY'RE KOLORKOTED – The entire length of the steel is spray painted an identifying color for permanent, quick-as-a-glance identification. Each piece of Milne tool steel keeps on telling you and your employees what it is. Milne's steels are practically confusion-proof.

MILNE'S TOOL STEELS ARE "UNFORGETABLE" BECAUSE EACH HAS A MATCHING HEAT TREAT CARD—With every shipment goes a heat treatment card of a color that matches the steel. Gives complete heat treat instructions. Eliminates costly wrong guesses.

With Milne Tool Steels you *can't forget what you get or how to treat it as long as you have it.*

The tool steel selector shown above helps you pick the proper Milne steel and gives you the complete story on it. Ask any Milne office for your copy, today.

SALES OFFICES & WAREHOUSES
NEW YORK 14, N.Y. Tel. WAtkins 4-3830
CHICAGO 7, ILL. Tel. MOnroe 6-2996
BOSTON 27, MASS. Tel. SOuth 8-5305
PITTSBURGH 12, PA. ALlegheny 1-6152
PHILA. 6, PA. LOmbard 3-5992
N. BRITAIN, CONN. Tel. 3-4183
CLEVELAND 5, O. BRoadway 1-3035
SALES OFFICES ROCHESTER 4, N.Y. Tel. BAker 1963

ST. LOUIS, MO. Tel. LUcas 1926
SPRINGFIELD 3, MASS. Tel. 6-7593
BRIDGEPORT 3, CONN. Bridgeport 5-0159
DAYTON 2, OHIO Tel. ADams 9063
ATLANTA, GA. Tel. Emerson 3716
PACIFIC COAST Office & Warehouse
SAN FRANCISCO, CAL. Tel. SUtter 1-8200

For Southern Calif. TAYLER-SPOTSWOOD OF CAL. Tel. LOgan 5-7461
For Pacific Northwest PACIFIC MACH. & TOOL STEEL CO. Portland 14, Oregon Tel. East 2148

SOUTHWEST VINSON SUPPLY CO. Dallas, Texas

CANADA SANDERSON-NEWBOULD, LTD. Montreal Toronto

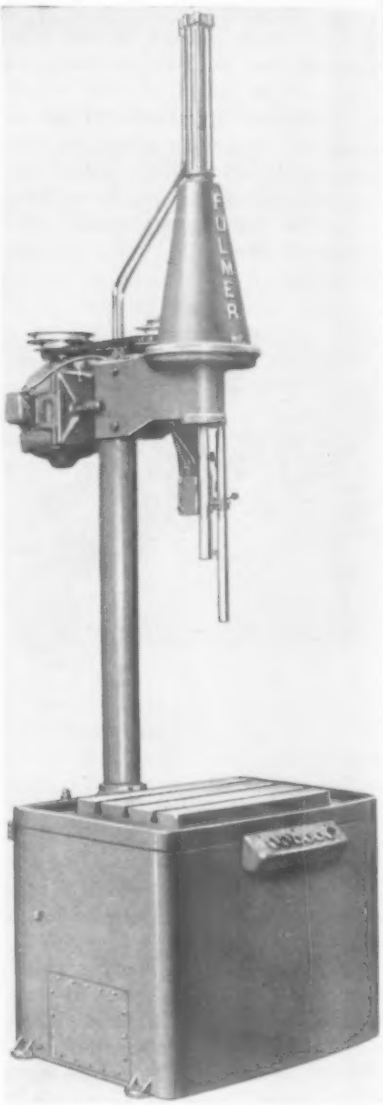
AM-4

A. MILNE & CO.
Established 1867
745 WASHINGTON ST., NEW YORK 14, N.Y.
America's Leading Tool Steel Specialists
Complete Line Of Tool Steels—Hollow and Solid

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-78

Vertical Honing Machine

The C. Allen Fulmer Co., Cincinnati, Ohio, has brought out a Vertical Honing Machine designed to finish bores from ¼ to 4 in. diameter. A smaller companion to the company's Model 412, this machine has a working stroke of 15 inches.

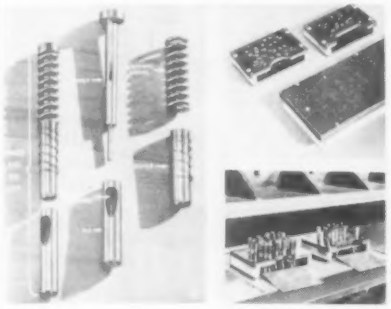


The machine carries a 1¼ in. dia. heat-treated alloy steel spindle driven by a 3 HP motor, with three spindle speeds available. A Vickers pump and controls provides hydraulic reciprocation at speeds from 1 to 70 rpm.

Standard height under the spindle nose is 40 in., with different heights optional. The T-slotted standard work table may be replaced with a special built-in indexing cylinder holding fixture, at extra cost, for those engaged in automotive cylinder honing. As extra features, a stop & dwell system for finishing blind holes, automatic cycling and a spindle brake are also available at a nominal added charge. **T-2-782**

Hole Punching Units

Announced by Wales-Strippet Corporation, No. Tonawanda, N.Y., is a Multiple Hole Punching System for unlimited hole punching patterns. This system provides a simpler, faster, more convenient and economical method of punching holes in sheet metal parts by permitting the entire setup to be made outside the punch press or press brake. In addition, the units are interchangeable and may be reused in an infinite range of setups, thus reducing inventory of parts. The units are used with Wales box-type or twin plates. The former are self-contained for punching small parts up to 21 x 23 in., the latter for punching larger parts up to 44 x 92 in.



The illustration at left shows the units assembled and disassembled, and photo at upper right shows the box-type plates and a partial view of a twin plate with support rail. The latter has been drilled for inserting the punch and die units. The photo at lower right shows two box type plates, on the same press bed, set up for progressive operations on the same workpiece. Both operations are therefore performed with the one stroke of the press. **T-2-791**

Abrasive Belts

The Hartford Special Machinery Co., Hartford 12, Conn., has developed a Diamond Abrasive Belt especially designed for use on carbide dies from ¼ to 9 in. I.D. The belts are made of solid nylon impregnated with diamond abrasive in grades from 1 to 5 microns to a sieve or mesh size of 100. The nylon cushions shock and retains the diamond chips in their sockets.

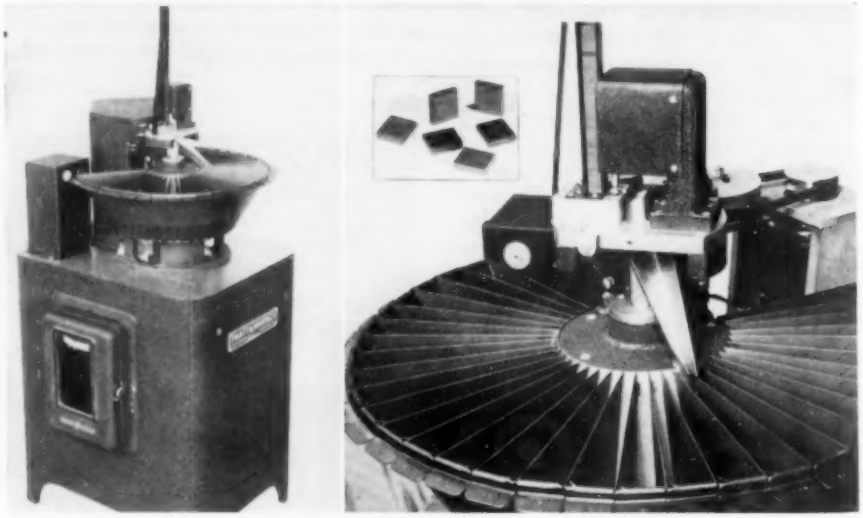
The belts are not affected by humidity and can be cleaned by washing in warm soapsuds. They are also impervious to oil, thus permitting use of light oil as a coolant. A special feature is "color coding", the color denoting the abrasive size. They are currently available in five colors and in standard lengths 75 and 105 in. Standard widths are ⅛, 3/16 and ¼ in. in the smaller sizes, while the larger belts come in widths 3/16, 5/16 and ⅜ inches. **T-2-792**

Step-Up Scale Speeds Scale Layouts

Said to "calculate for you" a draftsman's scale by Lindly & Co., 80 Herricks Rd., Mineola, L.I., N.Y., is designed to save time and to substantially reduce errors in making scale drawings and layouts. Scale ratios of 1:1, 2:1, 3:1, 4:1, 5:1, 8:1 and multiples of ten of these are quickly obtainable without resort to longhand multiplication. Simply choose the desired ratio, measure off the exact enlargement and read the correct "stepped-up" dimension. Complete information on this interesting development may be had from the manufacturer, mentioning The Tool Engineer. **T-2-793**

10" or 14"
TWIN WHEEL
WET OR DRY
TOOL GRINDER
For Carbide, Stellite, or High Speed Steel Tools.
one step from rough to finish grind
Heavy Duty
Wet or Dry
10" - 14" Wheels
PATENT PENDING
Type TD
10TD 10" - 14TD 14"
Twin Wheel
Tool Grinder
(Also SINGLE CUP WHEEL)
Also:
GRINDERS — ALL KINDS! UP TO 100 H.P.
BUFFERS — POLISHERS UP TO 60 H.P.
ABRASIVE BELT MACHINERY
SPECIAL MACHINERY
WALL
OLD WAY
Lost time between rough and finish grind.
Floor space wasted — Grinder must be away from wall.
NEW WAY
One step from rough to finish grind.
Conserve floor space — place Grinder against the wall.
Positively no spray or splash when grinding wet!
WRITE FOR BULLETIN 18 TODAY!
THE STANDARD ELECTRICAL TOOL CO.
WRITE FOR BULLETIN 18 TODAY!
2499 RIVER ROAD
CINCINNATI 4, OHIO
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-79

Selectronic Gage by Pratt & Whitney



A Selectronic gage by Pratt & Whitney Division, Niles-Bement-Pond Co., West Hartford 1, Conn., is designed to accurately classify critical tolerances of precision parts such as balls, rollers, pistons and piston pins. Essentially, it permits broader production tolerances in the manufacture of parts by providing a selective control for precision fitting at time of assembly.

As an example of its fine selectivity, the detail inset shows gaging of carbon vanes such as used in refrigerator compressor units. In these parts, a vane thickness tolerance of 0.0032 in. is allowed, the gage automatically separating the vanes into 32 classifications in increments of 0.0001 inch.

In this case, the vanes are magazine loaded and automatically fed under an Electrolimit gaging head which in turn, operates a photoelectric control unit which registers the size of the vane according to its thickness. It then directs it through the ejection chute to the proper classification bin.

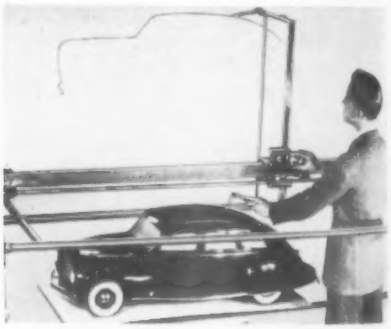
As each piece is gaged, an electric impulse passes through a commutator having 32 size classification segments, and this actuates the chute-positioning mechanism. Only one set of masters—a minimum and a maximum—is needed to adjust the gage. Individual increment settings, adjustments and tuning are not required.

The gages are custom designed and built to suit specific industrial applications. T-2-801

Contour Duplicator

A device designed to quickly reproduce on paper the exact contour of irregular surfaces has recently been placed on the market by Inter-Lakes Engineering Company, 4845 Bellevue, Detroit 7, Mich.

Called the "Dupligraph", the instrument transfers on transparent paper the exact contour of a plastic or clay model, such as the motor car model here illustrated.



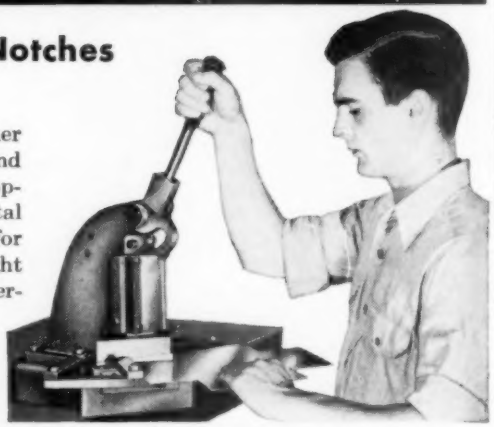
Its use is particularly advantageous for securing concave readings in forming dies which frequently cannot be checked with ordinary templates. It also solves the problem of securing a true reading of a stamping, die-casting, jet blade, and so on, showing the amount of spring-back and warp.

In the manufacture of products which require the close following of models, the Dupligraph gives cross-section lines relative to each other. This is usually done on vellum and checked against the draft or layout, the result being a full contour line as compared with the usual spot dimensional check. It is made in a number of sizes, including a small, low-cost model for small tool shops. T-2-802

THE di-acro NOTCHER

Duplicates Precision Notches WITHOUT DIES!

The new precision DI-ACRO Notcher eliminates the need for punch press and dies on many production notching operations. It is also ideal for experimental work as it can be quickly adjusted for any size or shape notch. Many straight shearing operations can also be performed with this flexible unit.



CUTS CLEAN—NO BURRS OR ROUGH EDGES

The powerful DI-ACRO Notcher has an exclusive roller bearing cam design which provides a tremendous pressure with a small amount of effort. The precision-ground Vee-shaped ram and blades of alloy tool steel assure clean cuts and permanent accuracy.

LARGE CAPACITY. The DI-ACRO Notcher cuts 90° notches up to 6" by 6" in 16 gauge steel in one operation. Larger notches, and wider or narrower angles, can also be obtained.

SEND FOR 40-PAGE CATALOG. Gives full information on all six "DIE-LESS DUPLICATING" production boosters—DI-ACRO Benders, Brakes, Shears, Rod Parters, Punches, Notchers—with many examples of accurately duplicated parts.

DI-ACRO is pronounced "DIE-ACK-RO"

DI-ACRO PRODUCTION EXAMPLES

DI-ACRO DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO.

375 EIGHTH AVENUE, LAKE CITY, MINN.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-80

PUMPS

FOR COOLANTS, LUBRICANTS, AND ABRASIVE LIQUIDS

PUMPS

POSITIVE DISPLACEMENT AND IMPELLER TYPES

PUMPS

J. I. C. STANDARDS OR DIRECT MOTOR CONNECTED

PUMPS

FOR TWENTY YEARS—DEPENDABLE, ECONOMICAL, EFFICIENT

Pioneer

PIONEER PUMP

& MANUFACTURING CO., INC.

•

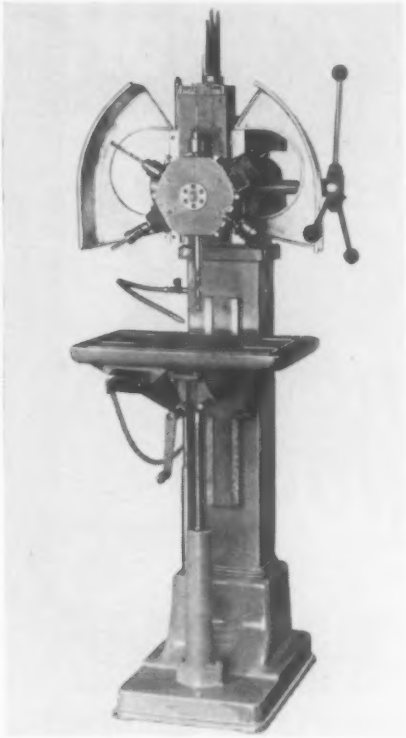
STANDARD OR SPECIAL, FOR EVERY MACHINE TOOL AND INDUSTRIAL USE

19645 JOHN R STREET
DETROIT 3, MICHIGAN

WRITE FOR CATALOG

INDICATE A-2-81-1

Improved Burgmaster



The Burgmaster 6-spindle automatic indexing drilling and tapping machine has been redesigned to provide greater versatility and added safety. The ram feed unit now has only three spokes, providing increased leverage and making large hole drilling relatively easier. A precision depth stop assembly, which indexes with the turret, provides depth control within limits of 0.001 in. Featured is a safety shield, now furnished as standard equipment, which protects the operator during index of the tool mountings. The Burg Tool Mfg. Co., 3743 Durango Ave., Los Angeles 34, Calif. **T-2-811**

Vernier Caliper

A chrome-steel, one-hand operated precision Vernier Caliper designed for "direct-reading" measurements is announced by Techno Exports, 15 Whitehall St., New York 4, N.Y. Of German make and in general design following conventional lines, the tool features a slide button which, on release, locks the vernier slide at any measuring position to the upper gib instead of the lower section; thus, the lower section is always flush against the caliper shank on thumb pressure or release. Hence, the jaws remain parallel.

The jaws, knife blades and depth rod are hardened, and the lower and upper scales are each graduated in inch and metric increments, readings being to 0.001 in. and 1/20 mm., respectively. The caliper measures work up to 5 5/16 inch. **T-2-812**

ENGINEERS

TO DESIGN, REDESIGN, OR DEVELOP YOUR PRODUCT

ENGINEERS

TO TOOL AND EQUIP YOUR PLANT FOR THE BEST PRODUCTION ECONOMICS

ENGINEERS

TO GET YOUR NEW PRODUCTION GOING AND KEEP IT GOING

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TO REDUCE YOUR COSTS AND IMPROVE YOUR QUALITY

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ENGINEERS, DESIGNERS, CONSULTANTS AND PRODUCTION SPECIALISTS

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INQUIRIES PROMPTLY ANSWERED

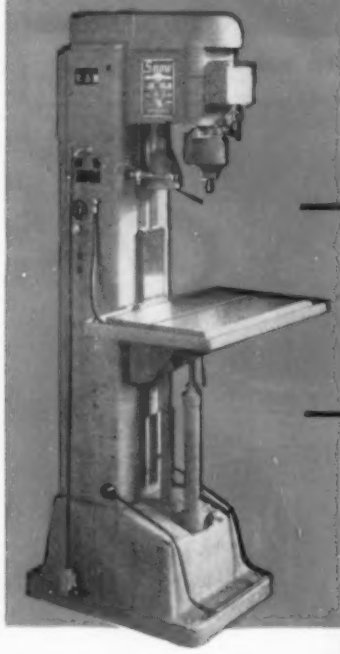
INDICATE A-2-81-2

Never Before

SO MANY ADVANTAGES for HIGHEST PRODUCTION

4800 PER HOUR!
3800 PER HOUR!
2500 PER HOUR!

For Top Production



SNOW

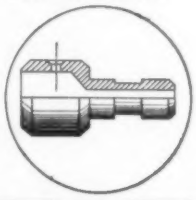
FULL UNIVERSAL MACHINES

Air operated, electrically controlled Snow tools are establishing amazing production records daily on a wide variety of work. Just note these typical examples:

DRILLING

Crossdrill and C'T" Sink 1/16" Hole

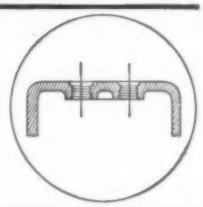
Material—Brass
Production—4800 per hour
Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine



TAPPING

Tap Two #10-32 Holes

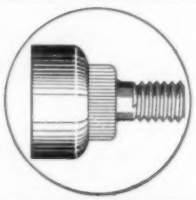
Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine



THREADING

3/8"—24 Thread—1/2" Long

Material—Die Cast Aluminum
Production—2500 per hour
Fixture—#10 Drum dial
Equipment—#3-TR Threading machine



Snow air operated—electrically controlled machines have built in full universal controls that allow selection of the type of spindle cycle desired. This feature also permits instant synchronization of the standard Snow Master Fixtures. All types of air operated automatic and semi-automatic jigs and fixtures are carried in stock. Standardization permits low cost tooling—and—high production.

Sensitivity of power application prevents tool breakage.

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North East IN

The Carborundum Company has established a marketing department consolidating the related functions of market research, advertising, sales promotion and public relations. The department will be under the direction of **Frederick T. Keller** who formerly was director of commercial research.

E. O. Clark recently was advanced to the position of industrial products sales manager for **Vickers, Inc.** Prior to his appointment, Mr. Clark was a district manager with offices in Worcester, Mass.

According to recent announcement, the board of directors of **Raytheon Manufacturing Company** has elected **Capt. David R. Hull,** USN (Ret.), as a vice-president of the company. Capt. Hull is manager of the equipment division of Raytheon.

Frederick W. von Raab has been appointed manager of warehouse distribution for **The Carpenter Steel Company.** Mr. von Raab, who has been with Carpenter since 1945, has a wide and diversified experience in the distribution of steel mill products.

The Machinery Manufacturing Company, former builders of the Vernon line of tools recently announced its reorganization under the name of **Diversified Metal Products Company** with facilities at 5125 Alcoa Ave., Los Angeles.

Robert L. Pettibone has been named to the position of chief metallurgical engineer for the **Sintercast Corporation of America.** Mr. Pettibone, who is a specialist in heat treatment of powder metal parts, formerly was research metallurgist for the company.

According to recent announcement from **Giddings & Lewis Machine Tool Co., Fred C. Freund** has been appointed assistant works manager, replacing E. L. McFerren as assistant to W. E. Rutz, executive vice-president and works manager.

At the same time **Ray G. Commo** was named supervisor of personnel, heading the industrial relations department.

West South INDUSTRY

Election of **H. Thomas Hallowell, Jr.,** to the presidency of Standard Pressed Steel Co. was announced recently, along with a number of management changes in the firm. Mr. Hallowell succeeds **H. T. Hallowell, Sr.,** who became chairman of the board.

Other changes included in the announcement gave Harold F. Gade, cofounder and present treasurer, the additional title of senior vice-president; named **Whiting Friel,** present sales manager, vice-president in charge of sales, and made **William I. Kryder** secretary of the company.

Crobalt, Inc. have moved into their recently completed plant at 2800 S. State St., Ann Arbor, Mich., according to an anouncement by the company president, L. D. Burnell. This building is the first of several units scheduled by the company.

Arthur T. Dalton, secretary of **Chicago Wheel & Manufacturing Co.,** has been appointed to the advisory committee, abrasive industry of the National Production Authority in Washington. Mr. Dalton, who has been associated with Chicago Wheel and Manufacturing for the past 26 years, functioned during the past world war as a member of the abrasive advisory group of the War Production Board.

Coming Meetings

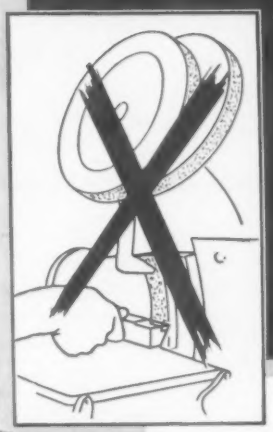
Mar. 14-17, Nineteenth annual meeting, **American Society of Tool Engineers;** Hotel New Yorker, New York.

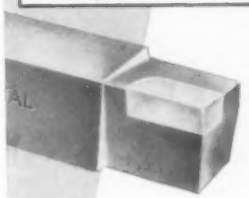
Mar. 19-23, Seventh Western Metal Congress and Exposition sponsored by **American Society for Metals** in cooperation with 20 national technical societies; Civic Auditorium and Exposition Hall, Oakland, Calif.

Mar. 19-23, "Conference on Industrial Personnel" on various phases of industrial organization and management, sponsored by **Department of Industrial Engineering, Columbia University;** to be held at the university, New York City.

Mar. 28-29, Conference on instrumentation for iron and steel industry, planned by Pittsburgh section of **Instrument Society of America** and the **Carnegie Institute of Technology;** Pittsburgh.

How to CONSERVE Grinding Wheels and Operator Time





Conservation of materials and manpower, always essential, becomes imperative in times of emergency.

Marked savings in equipment and labor required for maintenance operations are readily effected by using metal-cutting tools that stay sharp longer. The full significance of this obvious fact is perhaps not fully realized.

Kennametal tools, for example, work more hours per day, spend less time in the grinding room, and thus help sustain machine productivity, make operators more efficient, and reduce inventory. On important jobs they have demonstrated an ability to do up to four times as much machining per unit of carbide consumed.

This superior performance results from a unique coordination of manufacture and an all-inclusive control of properties—from raw materials to finished product.

Kennametal Inc., in its own plant, refines all carbides directly from ores, oxides, and by-products; processes these carbides into Kennametal compositions by means of exclusive methods and patented techniques; and fabricates complete tool and wear-part designs that utilize the distinctively uniform combination of hardness, strength, and wearability inherent in Kennametal. Outstanding among these efficient application developments is the mechanically-held technique, in which we pioneered.

A sure means to prevent waste of man-hours and equipment, therefore, is Kennametal tooling.

For those who wish assistance in developing tool applications that provide maximum cost-saving and productivity through utilizing the unique properties inherent in Kennametal, the Company maintains a corps of competent Field Engineers in all important industrial centers.

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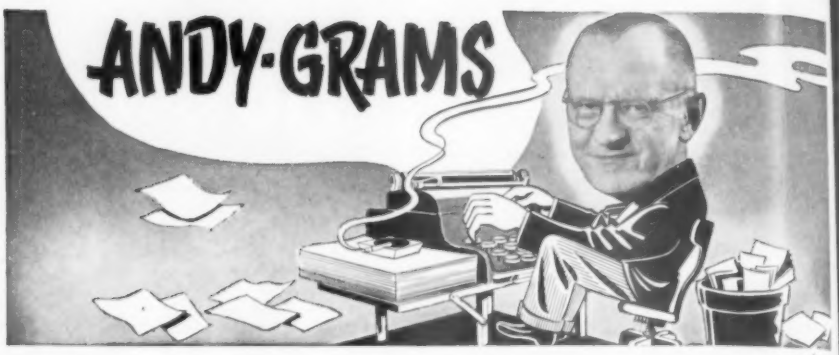

Well, the Holidays are over (for me, just over as of date of writing) and we settle down for another round with Father Time. In immediate prospect for the tool engineers is the ASTE Annual in New York, which the Society brass hopes will attract a goodly gathering. It should. And don't overlook the post-meeting trip to Bermuda, of which you've seen notice in the ASTE News. With things the way they are, tool engineers are going to be plenty extended and no telling about vacations come next summer. All abooooaaard!

From one thing to another, Bill Sherman dropped in on me, during a recent meeting of the Editorial Com'tee, to twit me about being so formal, special emphasis being placed on the striped pants as in the picture above. Well, what's a guy going to do when the artist only gives you one pair of pants? And at the rate I've been gaining weight pants are becoming a problem, apropos which—not to mention names—I'm minded to ask one of our most popular Society officers to save me out a few pairs of his for future contingencies. Never can tell but what a few extra inches(?) may come in handy.

Speaking of pants, I've been wondering what they did with all the ends they snipped off during the late (hot) war, when we couldn't have cuffs. As you may recall, the cloth so salvaged was to have some vague end use, maybe like making crazy quilts or something. Then, on being measured for a new suit a while back—oh, I loosen up now and then—the tailor said that he'd only recently thrown out bales of pants ends that had been gathering dust since Armistice Day. Now that another international issue is being debated maybe our brain trusters might strike a middle course between sanity and damphoolishness in materials conservation. Eh?

A note from Nils Goodrich, currently in Sweden but according to Tom Barber farmed out from Chicago (which of 'em is suburb of which?), with mention of an economic plan he'd submitted for consideration to the faculty of Texas Lutheran College. "Don't the college students need to study how to have permanent uninterrupted prosperity in the U.S.A.?" Nils wants to know.

Well Nils, as a student of economics you should be familiar with the many plans for permanent prosperity going the rounds here in the States. Like the Townsend Plan, Social Security, company pensions and scads of others, all with their merits yet all wholly or partly subsidized by the ultimate consumer, otherwise known as the taxpayer. Well, not all; some professional groups—like teachers—pay their own way and so insure a nest egg for retirement. And right there starts an endless circle, for just as soon as the economists work out a plan for retirement the sociologists have to step in with plans to keep the prosperous retired youngsters of 65 and over from giving up the ghost out of sheer ennui.

What, after all, is prosperity? For example, a man earning $1800 a year back in 1900 would have been considered prosperous—in fact, a d-d plutocrat—by the standards of the time; today, that money would barely buy rent and groceries for the average family. Times change, and concepts of prosperity change with cycles of inflation and deflation. One thing is certain, we're not going back to the so-called "good old days" except as higher taxes may reduce take-home pay to pre-World War I levels. And that may be okay if it'll buy more beefsteak and onions.

As for prosperity in America, I was sitting down to smorgasbord at the Stockholm with some friends a while back, the party including presidents, veeps and other executives of local industries, and John Markstrum, the latter a past ASTE Director and now an engineering consultant. For that matter, the entire group was composed of ASTE members or men known to our members, some possibly *auld acquaintance* to Nils Goodrich.

Anyway, we got to talking about the "state of the Union," and when we got

all through John Markstrum—who, incidentally, combines the quality of being an excellent engineer and a versatile writer—summed it all up as follows: "We're all of us too realistic not to concede flaws in our (American free enterprise) economic system, but in spite of its faults we are solidly agreed on one point:—that in spite of its faults no other system on earth offers such opportunity for economic independence to people willing to work for its achievement."

That, of course, doesn't mean that there's not room for improvement, and in that connection it's a healthy sign that at no time in our history has there been such mass thinking directed toward economic security, national as well as individual. Bank savings are increasing sharply; more than ever, people are buying insurance and annuities; and of particular significance is the acquisition by what may be termed the "little fellows" of corporate stocks and securities. If that keeps up it won't be long before America is one huge partnership in business and industry. And what could be more conducive to a sound and permanent national prosperity?

In rebuttal, it may be stated that periods of prosperity have always been followed by periods of depression. While the fact of past depressions would bear out that claim, the thought behind it, in my opinion, is sheer baloney. For example, it was contended that the slump of '29 was due to over-production, when the plain truth is that we were suffering from under-consumption. People were buying up to the crash, then of a sudden they were out of jobs with no money to buy with. It wasn't production that failed, but selling. Had sales been on the ball, there would have been market for all we could produce just as long as the majority of people were gainfully employed.

Well, I've been twitted about other things than striped pants, particularly about expressing serious thought instead of being the perennial humorist. But, we are living in serious times, and my page would fall short of its purpose if, at times, it could not be devoted to support of the American way of life. Anyway, it's usually inspired by comments from readers who also include serious thinkers. And that, gentle readers, is the lesson for today.

ASTEely yours

Andy

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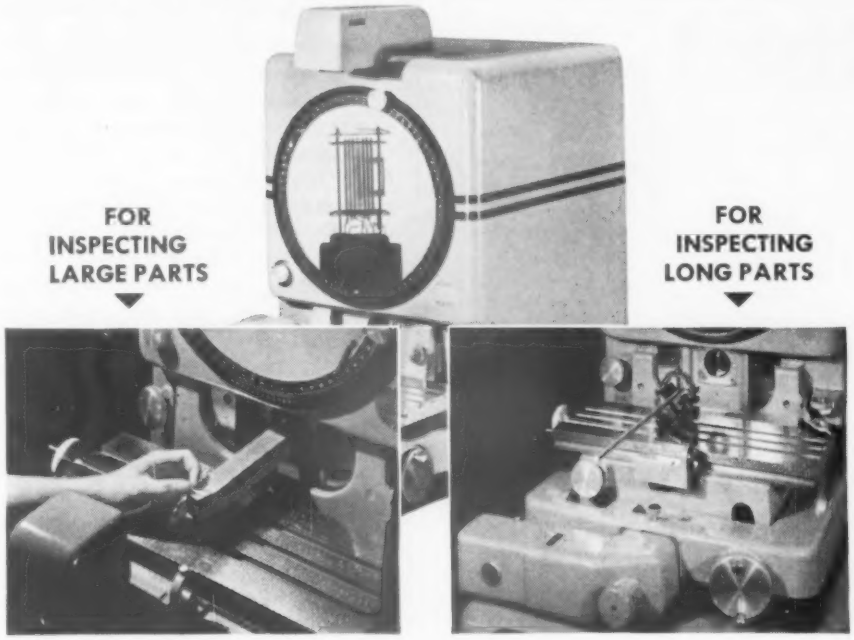

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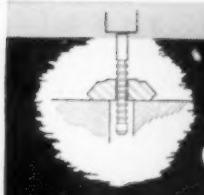

HELPFUL HINTS ON INCREASING BROACH LIFE

QUICK FACTS!

Page C-4

- OILS FOR BROACHING

Heavy Demand on Cutting Fluid

Broaching places a great demand on the cutting fluid due to the large amount of metal being removed and the necessity for maximum broach life and finish.

- Stuart's THREDKUT and related products, due to their high effective sulphur content, have been outstanding for the most severe broaching work. Active or effective sulphur in an oil serves as an anti-weld agent preventing metal seizure, welding and scuffing.

Slow Speed Broaching

- For unusually slow speed broaching of ferrous materials it is often desirable to use oils of heavier viscosity (such as THREDKUT #25) that will not drain off of the broach and the work before it has completed its mission.

Good Rule of Thumb

- When excessive front clearance wear is observed on the cutting teeth of the broach, DECREASE active sulphur in the oil by diluting with paraffin oil or other blending oils. When poor finish occurs due to pick-up and welding, apply Stuart's THREDKUT or THREDKUT #99 straight.

- **Use of Water-Mix Cutting Fluids**

On some flat surface broaching and on round hole work it is often desirable to use a water-mix cutting fluid of top quality. Stuart's SOLVOL, a heavy duty "soluble" oil, is widely recommended.

PROOF!

- "With their regular oil they only broached 12 pieces when the broach wore badly and bugged. This is a 4140, 240-270 Brinell forged gear blank with a 1" hole and ¼" deep keyway to broach at one pass with a combination broach, 1' for the round hole first, followed by 2' for the keyway.
- "They put in THREDKUT #99 and the broach was still in good condition after running 1500 pieces." WRITE FOR LITERATURE and ask to have a D. A. Stuart representative call.

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INDICATE A-2-86

Abstracts Of

Foreign Technical Literature

By M. Kronenberg

England: The present world situation is reflected by the increasing number of articles dealing with production of war materiel. An article on the Royal Ordnance Factory near Leeds, published in the November 3 issue of "*Engineering*," describes the production of the 50-ton "Centurian Tank" which is called Britain's latest fighting vehicle of its kind. According to claim, the Centurian is the only new tank to be produced in quantity by any nation (outside the Iron Curtain?) since the end of World War II. Approximately 1600 persons are employed in its manufacture.

The hull is fabricated in a rotatable manipulator. After the main welding has been completed, the hull is transferred to the manipulator where it can be rotated in two planes to facilitate downhand welding of numerous details. It is then passed along the assembly line after which the turret—also prepared on the assembly line—is fitted to it. The turret runs on steel balls which travel on flame-hardened races.

In an article by Alfred Herbert on "Safety in Industry," in "*The Engineer*" on October 27 and November 3, 1950, the well known author discusses his experience of 65 years in the machine tool industry and terms accidents "the nightmare which has haunted my otherwise happy working life." Recognizing the steady improvement in factory conditions, he indicates that much still remains to be done. He touches on numerous topics among which the following will be of general interest: light, floors, foot injuries, eye injuries, sepsis, dermatitis, ruptures, protective clothing, unexpected release of muscular tension, hand tools, abrasive wheels, belting, starting and stopping of machines. A wealth of information contained in the statistical data points to the conclusion that the greatest percentage of accidents occurs on planers, shapers and slotters, with those in heat treatment departments, foundry, lathe and drill operations following next.

More than 700 time study rating forms were completed during a national survey on that subject conducted by the University of Birmingham, England, as indicated in an article by Prof. T. U. Matthew in the December 1 issue of "*The Engineer*." The survey, supported by the Joint Committee on Measurement of Productivity and the Institute of Cost and Work Accountants, points out that great variations exist in time study methods. Particular interest was shown in a new method of analysis and the demand to participate was so great that more meetings are contemplated. About 200 firms participated in the sixteen meetings held at various places in England.

France: A superfinishing machine recently developed in France is discussed by A. Meynier in "Revue Générale de Mécanique" pages 303-307 of the August, 1950, issue. Referring to the original work done by the Chrysler Corporation in the field of superfinishing, the author indicates that it was held generally in Europe, prior to the war, that this process would find wide application as it permits production of high quality surfaces. Contrary to expectations, however, the process found only limited applications.

The author has made a study into the reasons of this "semi-failure" and investigated new superfinishing machines which are particularly adapted to French production. These machines make use of a principle developed by M. Berstecher for the French War Production Board (Direction des Etudes et Fabrications d'Armements).

This principle is based on frequency resonance occurring at 1500 to 3000 cycles per min., produced by exciting a torsion bar which transmits oscillations to the tool holders. Since vibration exciter speed can be regulated by a control box and an eccentric control, it is possible to vary frequency and amplitude of the tool holders. In the event that the imposed frequency of vibration is close to the natural frequency of the tool holders, resonance occurs, increasing amplitudes. Hence, by this method it is possible to vary the amplitude periodically. It is claimed that the "American multimotion method" has been replaced in this way by a motion which can easily be controlled and which also permits a reduction in superfinishing time since the time is proportional to the frequency of vibration.

The new principle also can be incorporated into superfinishing attachments for lathes. The attachments are very useful in cases where only a limited number of workpieces shall be superfinished.

Germany: A trepanning process for gun barrels, which was developed in Germany during the Second World

War, is discussed by W. Iwascheff in "*Werkstattstechnik und* Machinenbau." This method consists of leaving a core in the hole and cutting only a cylindrical piece. Tests have shown that best results were obtained with trepanning when the core diameter is about 2/3 of the hole diameter.

The basic problem connected with improving trepanning processes lies in the proper relationship of cutting speed, feed, and width of cut and in the control of hydraulic pressure for chip removal. Performance of the machines also is substantially affected by the magnitude of the thrust. In older trepanning processes, chips were removed between the OD of the boring bar and the ID of the hole, while the coolant was supplied through the boring bar. This procedure is reversed in the new process, by supplying the coolant between OD of the bar and ID of the hole and removing chips through the hollow bar. Less clogging occurs and the machined surface is not marred. Numerous details as to tool design are discussed for obtaining the high production rate, which was about eight to ten times the production obtained in this country, when measured by the penetration in ft/ hour.

An international meeting on welding, held recently in Germany, is discussed in "*Zeitschrift des Vereins Deutscher Ingenieure*" of November 1, 1950, by G. Engel. Papers were presented by authors from the U.S.A., Switzerland, Sweden and Germany. The American, Messrs. Kinzel, Swan and Biers, discussed "Ten years of welding progress in U.S.A.", while C. G. Keel, Switzerland, discussed "Welding in Western Europe". A Swedish contribution, by B. Kjellberg, referred to a "New Method for Testing Weldability". Among the German papers a study by H. Buchholtz on "Weldability of Structural Steel" and an investigation by P. Voight on "Welding of plastic materials" will be of interest to tool engineers.

The development of high speed steel is the topic of report #723 of the Committee on Materials of the German Mining Engineers as indicated in an article by R. Scherer and W. Connert, published on October 29, 1950, in "*Stahl & Eisen*". The report covers a very carefully prepared study on the development in composition and application of high speed steel since 1938, with particular reference to the raw material situation in Germany. Results of rough turning tests are presented, investigating the effect of tungsten, molybdenum, vanadium, cobalt, titanium, chromium, carbon and aluminum contents on cutting performance. Numerous diagrams and comparative data are given.

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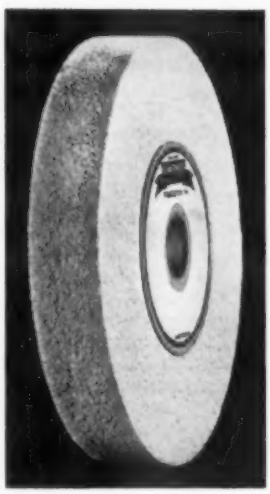

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Good Reading

A GUIDE TO SIGNIFICANT BOOKS AND PAMPHLETS OF INTEREST TO TOOL ENGINEERS

TOOL ENGINEERING, by A. P. Giwiazdowski, M. E. Published by the C. C. Nelson Publishing Co., Appleton, Wis. 320 pp; price $4.00.

The author, who is Professor of Industrial Engineering at Tri-State College and an ASTE member, approaches his subject from a rather novel angle, as text books go. Primarily written as a text book, the opening chapter is given over to a resume of invention and development in engineering fields. Thus, he not only provides a background for his subject but gives the student a realization of both the dignity and possibilities of tool engineering.

Next, the subject matter has been presented as a series of manufacturing processes cemented together by the design of tools for a representative machine part, in this case a connecting rod. Throughout the whole, there is a continuity relieved by detailed discussion of "do's" and "donts" in tool engineering.

The major metal cutting techniques —grinding and honing; milling; broaching; drilling; extrusion; stamping and so on—are comprehensively treated, as are gaging and measuring, calculation of gears, and procedures in tool design. One chapter is devoted to industrial organization. On the whole, a well rounded and interesting work admirably suited to the needs of students in tool engineering.

PRESSWORKING OF METALS, by C. W. Hinman, second edition. Published by McGraw-Hill Book Company, New York, N. Y. 551 pp, illustrated; price $8.50.

The work of an accepted authority in the field, this revised second edition has been reorganized and expanded in line with the rapid development of power presses, press tools and accessories. Over 1000 press tool designs, types of presses and attachments, and tooling equipment are presented along with concise information regarding their application to everyday die engineering practice.

Included are edge-up forming dies, and techniques for numerous difficult operations such as drawing square cornered shells, any depth; drawing aluminum alloys; blanking and piercing sheet mica; and drawing pronged shells without distortion among many others. Economics of pressworking are also included, and the book further contains formulas and reference tables which, according to the publisher, have not previously been published.

(Continued on page 91)

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
A-2-124-1	ACME SCHOOL OF DIE DESIGN ENGINEERING		Information on schools correspondense courses and resident schools.
A-2-92	ADAMAS CARBIDE CORP.		Illustrated booklet "Braze and Save" discusses economies of brazing own carbide tools.
A-2-14	ALLEGHENY LUDLUM STEEL CORP.		Comprehensive 72-page catalog lists stocks of high speed and tool steels maintained at company's warehouses.
A-2-115	ALLOY RODS CO.	Bulletin 2519	Complete description, properties and welding procedures of "Tool-Arc" electrodes.
A-2-16	AMERICAN BROACH & MACHINE CO.	Circular 300	Covers company's vertical hydraulic surface broaching machines.
A-2-117	F. E. ANDERSON OIL CO.		Case history material on broaching, drilling, tapping or grinding.
A-2-22	BEHR-MANNING		"Proving Ground" presents the story of better belt finishing methods.
A-2-127	CHARLES H. BESLY & CO.		Up-to-date booklet contains authoratative information on modern grinding wheels.
A-2-132-3	CERRO DE PASCO COPPER CORP.	Bulletin B-5	Informative brochure, "How To Make Chuck Jaws."
A-2-128-2	CHICAGO RIVET & MACHINE CO.		Engineering data, rivet specifications plus illustrated descriptions of firm's automatic rivet setters.
A-2-100	THE CINCINNATI SHAPER CO.	Catalog N-5	Complete catalog on Cincinnati's shapers.
A-2-96	CRUCIBLE STEEL CO. OF AMERICA		Crucible Tool Steel Selector for choosing proper steel for specific purpose.
A-2-85	EASTMAN KODAK CO.		Booklet on Kodak Contour Projector describes advantages, uses and operation.
A-2-139	EX-CELL-O CORP.	Catalog 25962	Catalog deals with company's precision grinding spindles.
A-2-119	HANNA ENGINEERING WORKS	Catalog 254	Gives information on solenoid valves, and includes details on company's complete valve line.
A-2-98	HANNIFIN CORP.	Bulletin 150	Presents story of "Hy-Power Hydraulic," stressing economy, efficiency.
A-2-77	HOWE & FANT, INC.		Literature on "Lign-o-matic" turrets for drill press operations.
A-2-2	LANDIS MACHINE CO.	Bulletins F-80, F-90, A-50	Explain operations and advantages of company's thread chasers.
A-2-124-2	W. F. MEYERS CO., INC.	Catalog 13	Detailed information and price list on carbide inserted drill jig bushings.
A-2-126-4	THE MOTCH & MERRYWEATHER MACHINERY CO.	Bulletin 250-T	Detailed information on standard line of slitting and slotting blades as well as special blades to order.
A-2-138	NATIONAL BROACH AND MACHINERY CO.	Bulletin 49-11	Pertinent information on broaching and problems of broach users.
A-2-103-3	NEW HERMES, INC.	Catalogs H-41, IM-41	Deals with heavy duty and with protable Engravograph.
A-2-137	VICKERS, INC.	Bulletin 50-61	Information on Vicker's custom built hydraulic power units.
A-2-108	WALES-STRIPPIT CORP.	Catalogs BL and N	Fully illustrated brochures stressing savings in time and investment through use of Wales equipment.
A-2-91	WENDT-SONIS CO.		Reaming instrution chart determines feeds and speeds for cutting steel, ferrous, non-ferrous and non-metallic materials.
A-2-110	WIEDEMANN MACHINE CO.	Bulletin 241	Describes most efficient method of producing chassis and similar work in short runs and semi-production runs.

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FREE BOOKLETS AND CATALOGS CURRENTLY OFFERED BY MANUFACTURERS

Broaching Machines, Presses

Data, specifications and other pertinent information on company's standard line of fluid power broaching machines and presses contained in bulletin 10052; illustrated. *The Oilgear Co.*, 1560 W. Pierce St., Milwaukee 4, Wis. **L-1**

Lathes

Bulletin HLV, "The Greatest Advance in Lathe Construction," presents company's more recent lathe emphasizing its exclusive features; also gives complete specifications and information for both regular and extra equipment. *Hardinge Brothers, Inc.*, Elmira, N. Y. **L-2**

Die Sets

Illustrated 72-page catalog covers line of master and commercial as well as semi-steel and all steel die sets, die makers' accessories and toolroom and machine shop equipment; photos, diagrams and easy-to-read tables simplify selection; color indexed for quick reference. *The Producto Machine Co.*, Bridgeport 1, Conn. **L-3**

Ball Bearings

Twentieth edition of ball bearing catalog contains features of interest to ball bearing users including simplified aids for selection of types and sizes for various loads and speeds; load rating tables give both radial and thrust capacities. *New Departure Div., General Motors Corp.*, Bristol, Conn. **L-4**

Plating

Data sheet recently developed on tin-zinc plating process explains its analysis, properties, uses, application, advantages and disadvantages. *Metal & Thermit Corp.*, 100 East 42nd St., New York 17. **L-5**

Strip Steel

Quarterly publication, "Confab" contains items on successful customer applications of company's methods and products plus other suggestions and news of interest to users of strip steel products. Advertising and Sales Promotion Dept., *Acme Steel Co.*, 2840 Archer Ave., Chicago 8. **L-6**

Sharpening Cutters

Booklet M 1714, "Recommendations for Sharpening Carbide Milling Cutters," outlines equipment required, general rules, specifications of grinding wheels for sharpening; discusses milling cutter elements, clearance angles; illustrated. *Cincinnati Milling and Grinding Machines, Inc.*, Cincinnati 9. **L-7**

Surface Grinders

Illustrated brochure 847-2RM pertains to the Mattison (Hanchett type) vertical spindle surface grinder; specifications tables included. *Mattison Machine Works*, Rockford, Ill. **L-8**

Alloys

Company's line of alloys recommended for corrosion applications, outlines of their physical properties and a guide to chemical agents best handled, is subject of 4-page folder; also includes information on numerous other of company's products. *Ampco Metal, Inc.*, 1745 S. Thirty-eight St., Milwaukee 15, Wis. **L-9**

Circular Saw Blades

Triple-chip solid and segmental circular saw blades described in bulletin 201 which explains details and advantages of this method of sawing; tables present data and specifications for standard sizes; also pictures and describes sharpeners. *The Motch & Merryweather Machinery Co.*, Penton Bldg., Cleveland 13. **L-10**

Power Tools

Catalog AB-50 presents deatiled information including product specifications, prices, motor recommendations, of metalworking, woodworking and other machines in Delta line; also gives accessory listings. *Delta Power Tool Div., Rockwell Mfg. Co.*, Milwaukee 1, Wis. **L-11**

Clamps

Four-page folder shows company's "all-purpose" jaw clamps; outlines main points and illustrates operation. *J & S Tool Co.*, 477 Main St., East Orange, N. J. **L-12**

Steel Hardening

"New Machines for Flame-Hardening" discusses four methods for hardening steel by heating slightly above its critical temperature and cooling rapidly; fully describes machines produced for this process. *The Linde Air Products Co.*, 30 East 42nd Street, New York 17. **L-13**

Automatic Lathes

Two folders describe company's Models 12A and 8A automatic lathes for both short and long run turning; incorporate complete information on spindle speeds, wide range of cycles available, specifications, dimensions and shipping data plus outlines of special features, engineering and specification drawings. *Sundstrand Machine Tool Co.*, 2531 Eleventh St., Rockford, Ill. **L-15**

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(Continued from page 88)

PROPERTIES OF METALS AT ELEVATED TEMPERATURES, by George V. Smith of the Research Laboratory, U. S. Steel Corporation. Published by McGraw-Hill Book Co., New York, 400 pp; price $7.00.

Said to be among the first of definite treatises on high-temperature metallurgy, this book should prove of more than ordinary interest in the field of nuclear engineering, high speed flight, and turbine development.

To a large extent, the work is based on developments after the first World War, when the fuel economy resulting from higher steam temperature, and increased yield of gasoline obtained by thermal cracking, created a demand for metals which would withstand higher temperatures and pressures. As, for example, an increase in steam temperatures from about 650 deg F to 1050 deg F, as at present.

The initial portions of the book deal with the fundamentals of plastic flow and fracture of metals at ordinary and then at elevated temperatures, all preparatory to a consideration of test apparatus used in evaluating metals for elevated temperature service. Subsequent chapters cover the effects of variables, changes which occur in service, and problems of design.

SMALL PLANT MANAGEMENT, a guide to practical know-how management prepared under the auspices of the Management Division of the American Society of Mechanical Engineers. Edited by Edward H. Hempel, Ch'man Small Plant Committee, ASME. Published by McGraw-Hill Book Co., New York, N. Y. First edition, 548 pp; price $6.00.

An unusually complete guide to practical "know how" management based on a systematic study of small plant activities in different industries throughout the country, this work describes and illustrates modern concepts and improved procedures of planning, organizing, operating and supervising. Its aim is to enable the reader to develop management methods that result in minimum cost per unit, and consistent with least management attention.

The context progresses in order through four major sections: small plants as economic factors; management tasks; how to solve the problems of small plant management; and small plant future. Among pertinent topics are financing and banking, organization of plant, principles of scientific management and so on through sales planning and legal requirements. From cover to cover, interesting and instructive reading.

A Reamer for Every Job—

GREATER PRODUCTION AT LOWER COST!

Just one big happy family — to bring you increased production . . . less tool cost . . . greater accuracy . . . better finish. Let the W-S family of Carbide Reamers go to work for you. Choose from a complete range of sizes, wide selection of styles and straight or taper shanks of special heat treated alloy steel. Quick delivery — from your Wendt-Sonis distributor.

Free! *New Reaming Instruction Chart Determines feeds, speeds and stock removal for reaming steel, ferrous, non-ferrous and non-metallic materials. Write today: Wendt-Sonis Company, Hannibal, Missouri.*

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CARBIDE CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS
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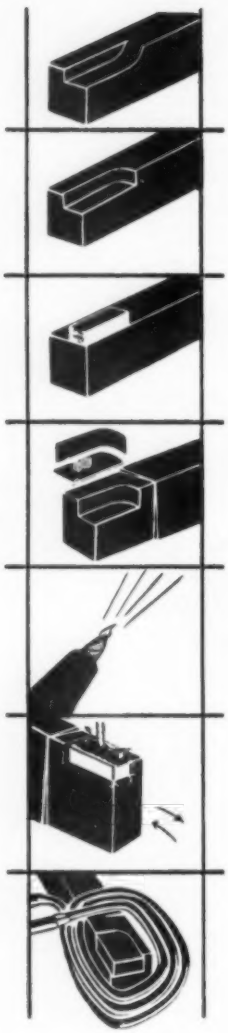
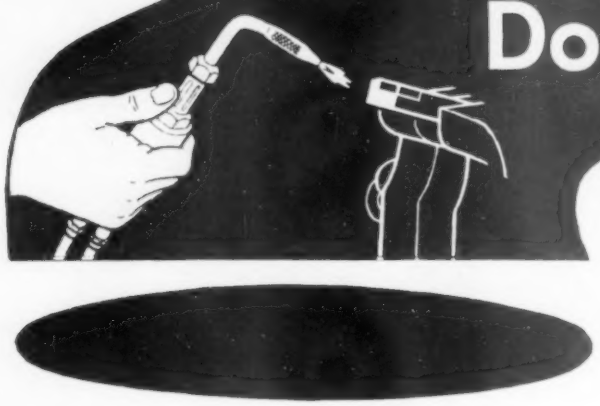
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-91

Smart Carbide Users BRAZE & SAVE! Do You?





Are you taking advantage of the savings in money, time and headaches by brazing your own carbide tools with **ADAMAS TUNGSTEN CARBIDE?**

Brazing your own tools with durable **ADAMAS** carbide is simple, requiring no special equipment or technical knowledge.

How you save money— ★ Shank steel and **ADAMAS** carbide tips are inexpensive. ★ Increased use of present tool room facilities. ★ Preformed **ADAMAS** tips require little grinding with costly diamond wheels. ★ Maintain economical low level of finished tool inventory.

How you save time— ★ Quick delivery on standard and special **ADAMAS** tips. ★ Eliminate costly down time waiting for tools. ★ Direct control of carbide tool production schedules.

Convinced of the advantages and economy for carbide tool users, **ADAMAS** is concentrating on the job of maining the *fastest delivery schedule* of *quality* tungsten carbide *at lowest competitive prices.*

Write for valuable free illustrated booklet "Braze and Save" to Dept. V

ADAMAS CARBIDE CORPORATION
1000 South 4th Street • Harrison, New Jersey

DO IT FAST

P&J Tooling Specialists can help you tool up to speed up the precision-production of duplicate parts. They know best how to group and combine multiple operations — how to engineer secondary operations into a main setup — how to eliminate all unnecessary work handling.

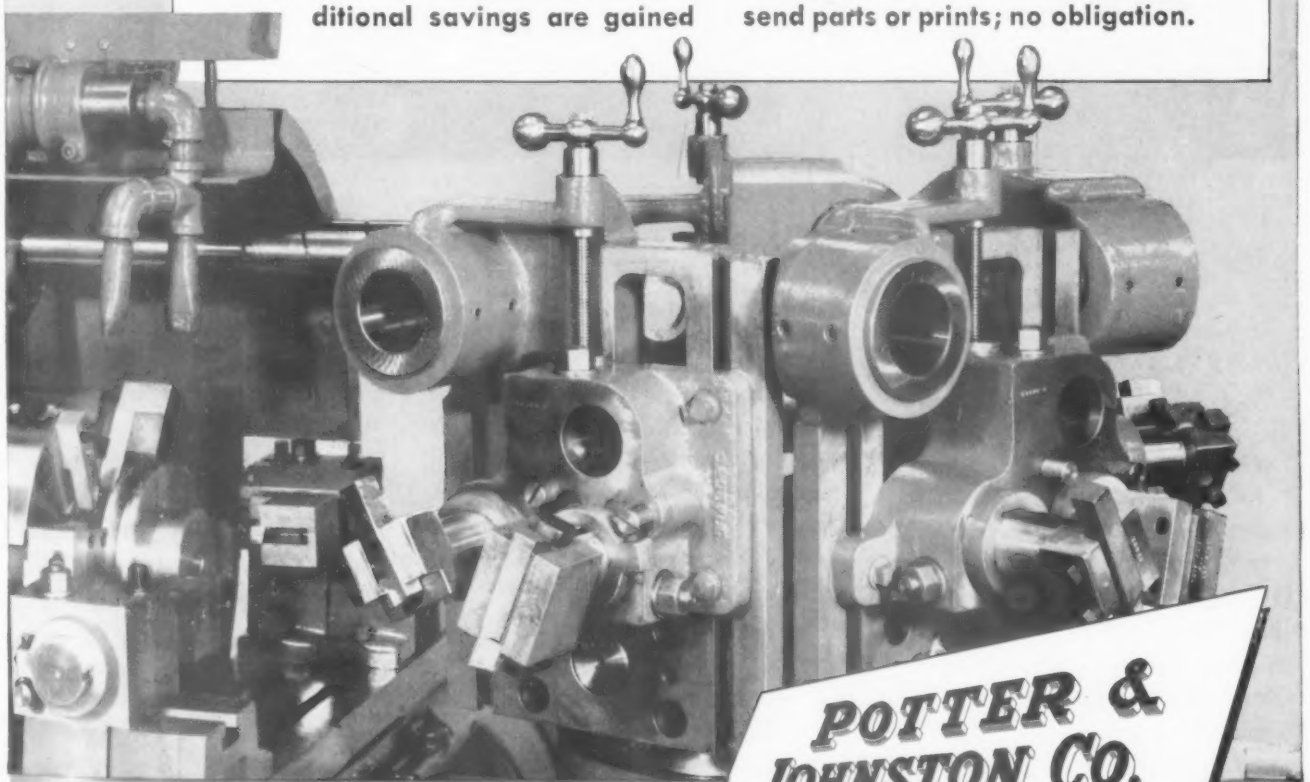
DO IT PROFITABLY

In countless instances, modern quality control inspection methods are demonstrating the ability of precision-built P&J Automatics to perform the most exacting operations to close tolerance standards—to turn out better work—and more of it—with fewer rejects—at lower cost-per-piece.

DO IT WITH P&J TOOLING ON POTTER & JOHNSTON AUTOMATICS

P&J Automatics come in a wide range of models and capacities for the production-machining of anything from a few ounces to several hundred pounds. They'll give you maximum economy in tooling and production costs. Additional savings are gained from the divided labor costs of one man's operation of 2 or more Machines.

P&J Tooling Specialists will work out tooling recommendations and time estimates to demonstrate P&J economy on your work. Simply send parts or prints; no obligation.



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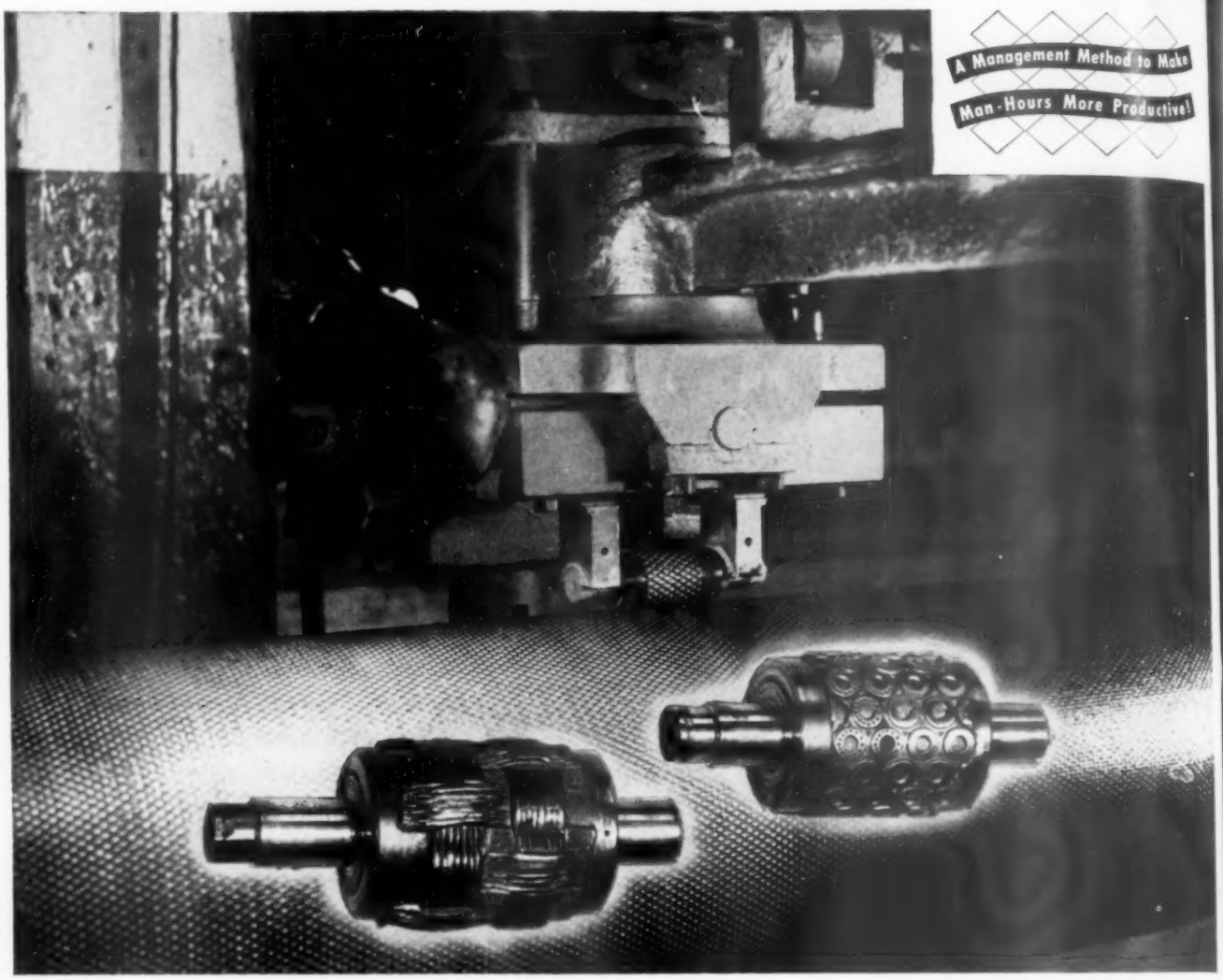
More than 50 Years' Experience in Tooling for
PRECISION + PRODUCTIVITY + ECONOMY



How to Put Delicate Patterns Through a 5-Ton "Wringer", Successfully

These knurling mills, made from No. 11 Special (Water-Hard) Tool Steel, press artistic patterns into large steel rolls for embossing cloth, paper and plastic. Here's what was required of the tool steel: It had to be hard enough to prevent upsetting; tough enough to prevent delicate edges from breaking under operating pressures up to 5 tons. Patterns on the mills were quite fragile and sections as deep as $\frac{1}{16}$" could not collapse. Further, the steel had to heat treat with very little warpage.

But picking the proper steel wasn't as tough as you may imagine. For the Carpenter Matched Set Method not only indicated the one *best* steel for the job but enabled production management to "call its shots" . . . have the mills produce the required number of patterns on schedule, with less costly downtime.

For any plant making or using tools and dies, the Matched Set Method offers even more advantages than simplified selection. You benefit from lower tool steel inventories, heat treating economies, simplified toolroom and production procedures. To discover how it can work for you in your plant, write for the new booklet "How to Get Better Tool and Die Performance". THE CARPENTER STEEL CO., 154 W. Bern St., Reading, Pa.

Export Department:
The Carpenter Steel Company, Reading, Pa. "CARSTEELCO"

Carpenter

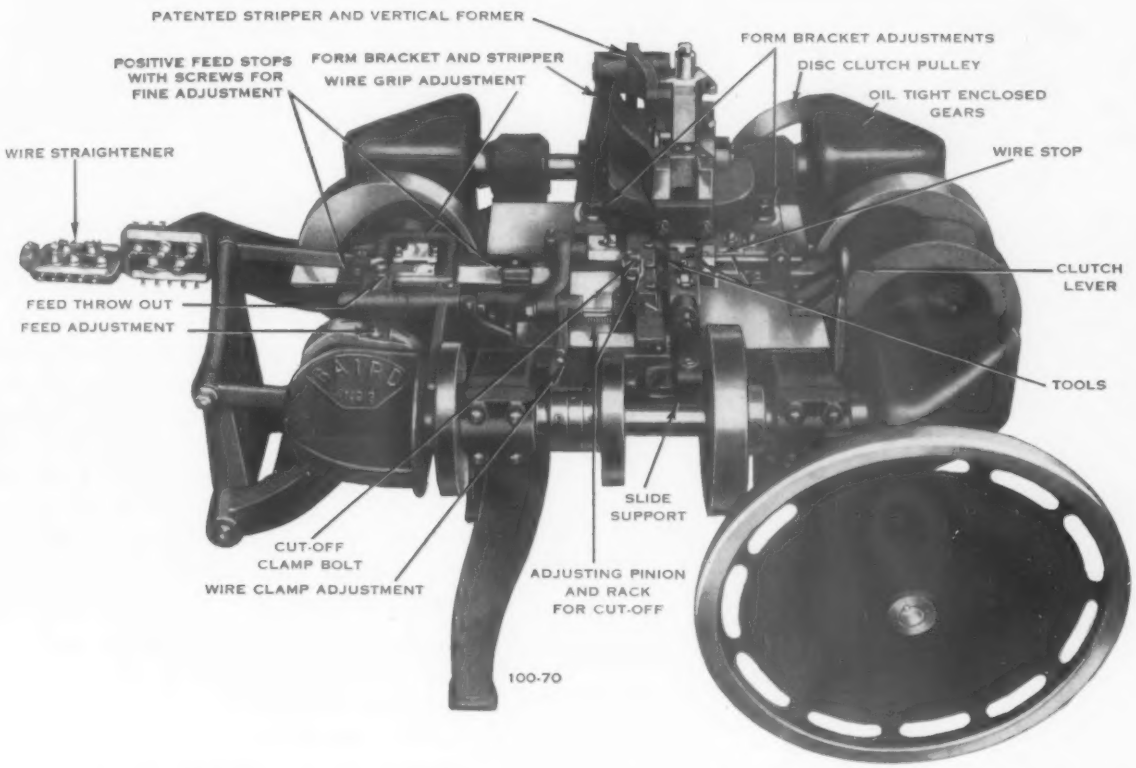
MATCHED TOOL & DIE STEELS

More than top-grade steels . . . a Method to keep tooling and production on schedule!

For your convenience, Carpenter carries warehouse stocks in principal cities throughout the country

ASK BAIRD ABOUT IT!

HIGH PRODUCTION TOOLING



WIRE FORMS and COILED STRIP WORK *"unlimited"* with BAIRD FOUR SLIDE Automatics

The FOUR SLIDE is actually a basic design of machine, not a jack-of-all-trades, but one which we stock and tool to your specific requirements for high speed repetitive production. There are 8 standard sizes that cover wire diameters from 1/32" to 1/2" and ribbon widths from 3/16" to 1-3/8" . . . larger capacities on special order.

Machines may be supplied with crowned pulley for V belt drive from countershaft, or with standard or variable speed motor drive mounted directly on the machine . . . V belt from motor sheave to machine pulley. Operation is smooth and quiet.

Tooling possibilities are extensive and can still be increased by the ingenuity of the toolmaker.

Standard attachments are Form Raising, Pin Pulling, Ring Setting and Horizontal Presses. Special attachments will be designed and built to suit specific jobs.

To discover how you can cut costs with this Four Slide machine . . . "ask Baird about it."

the BAIRD MACHINE COMPANY
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

5BA51

"no more GAMBLING on tool steel selection"

[⅓ actual size; Selector is in 3 colors]

Since the first announcement, hundreds of tool steel users have received their CRUCIBLE TOOL STEEL SELECTORS. The comments received indicate that this handy method of *picking the right tool steel right from the start* is going over big.

"Handiest selector I've ever seen"

"No more gambling on tool steel selection"

"You're right, the application should dictate the choice of the tool steel" . . . and many, many more favorable comments.

You'll want your CRUCIBLE TOOL STEEL SELECTOR. It uses the only logical method of tool steel selection—begin with the application to pick the right steel! And the answer you get with one turn of the Selector dial will prove satisfactory in every case, for the CRUCIBLE TOOL STEEL SELECTOR covers 22 tool steels which fit 98% of all Tool Steel applications. ALL the tool steels on the Selector are in Warehouse Stock . . . that means when you get the answer, you can get the steel . . . fast!

Write for your Selector today! We want you to have it, because we know you've never seen anything that approaches your tool steel problems so simply and logically. Just fill out the coupon and mail. Act now! CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N. Y.

Here's how it works:

To use the Selector, all you need know is the characteristics that come with the job: type and condition of material to be worked, the number of pieces to be produced, the method of working, and the condition of the equipment to be used.

FOUR STEPS—and you've got the right answer!

1. Move arrow to major class covering application
2. Select sub-group which best fits application
3. Note major tool characteristics (under arrow) and other characteristics in cut-outs for each grade in sub-group
4. Select tool steel indicated

That's all there is to it!

Here's an example:

Application—Deep drawing die for steel

Major Class—Metal Forming—Cold

Sub-Group—Special Purpose

Tool Characteristics—Wear Resistance

Tool Steel—Airdi 150

One turn of the dial does it!

And you're sure you're right!!

Crucible Steel Company of America
Dept. T, Chrysler Building
New York 17, N. Y.

Gentlemen:

Sure! I want my CRUCIBLE TOOL STEEL SELECTOR!

Name_____ Title_____

Company_____

Street_____

City_____ State_____

CRUCIBLE first name in special purpose steels

TOOL STEELS

fifty years of Fine steelmaking

Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DENVER • DETROIT HOUSTON, TEXAS • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH • PROVIDENCE ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.

Tough drilling job got you *Trapped?*

USE the best tools to get out tough jobs. They save time and save production costs. Standard Red Shield Tools are tops—in material—design—construction.

Over 70 years' experience in the cutting tool industry can be put to work for you. Just give one of our *Standard* service men an opportunity to make suggestions. There's no obligation, of course.

Industrial Supply Distributors in more than 529 cities across the United States stock and supply Standard Red Shield Drills—Reamers—Taps—Dies—Milling Cutters—End Mills—Hobs—Counterbores—and Special Tools.

Standardize on the Standard line. You will save time and costs—and get results.

STANDARD TOOL CO. CLEVELAND 14, OHIO

New York • Detroit • Chicago • San Francisco

THE STANDARD LINE: *Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Hobs • Counterbores • Special Tools*

Every TOOL ENGINEER will want a copy of this NEW BULLETIN!

. . . find out what 5,000 p.s.i.

Hannifin "HY-POWER" Hydraulic Power Units

can do for YOU

"HY-POWER HYDRAULICS" now makes it practical for tool makers, machine builders, and design engineers to employ hydraulic pressures up to 5,000 p.s.i. under finger tip control to solve innumerable manufacturing problems more efficiently and economically than ever before possible.

"HY-POWER HYDRAULICS" with its fast, automatic operating cycle offers manufacturing plants, large and small alike, almost unbelievable opportunities to reduce unit costs, save time, and improve the quality of work produced on a wide variety of riveting, punching, pressing, shearing, multiple punching, and multiple riveting operations.

For the complete story of "HY-POWER HYDRAULICS", see your local Hannifin representative or send for a copy of new Bulletin No. 150. "HY-POWER HYDRAULICS" is a remarkable engineering development pioneered by Hannifin. *Find out what it can do for YOU!*

HANNIFIN supplies everything you need to make "HY-POWER HYDRAULICS" work efficiently and dependably for you.

HYDRAULIC PRESSURE GENERATORS—The heart of the "Hy-Power" System! Up to 5,000 p.s.i. pressure at your finger-tip under exclusive automatic control. Capable of delivering hundreds of tons of useful force. (Illustrated above).

"HY-POWER" HYDRAULIC CYLINDERS — Built to work at various pressures up to 5,000 p.s.i. Heat treated alloy steel bodies with precision ground bore. Alloy steel rod, case hardened and ground. 9 standard sizes, 2" to 7¼" bore.

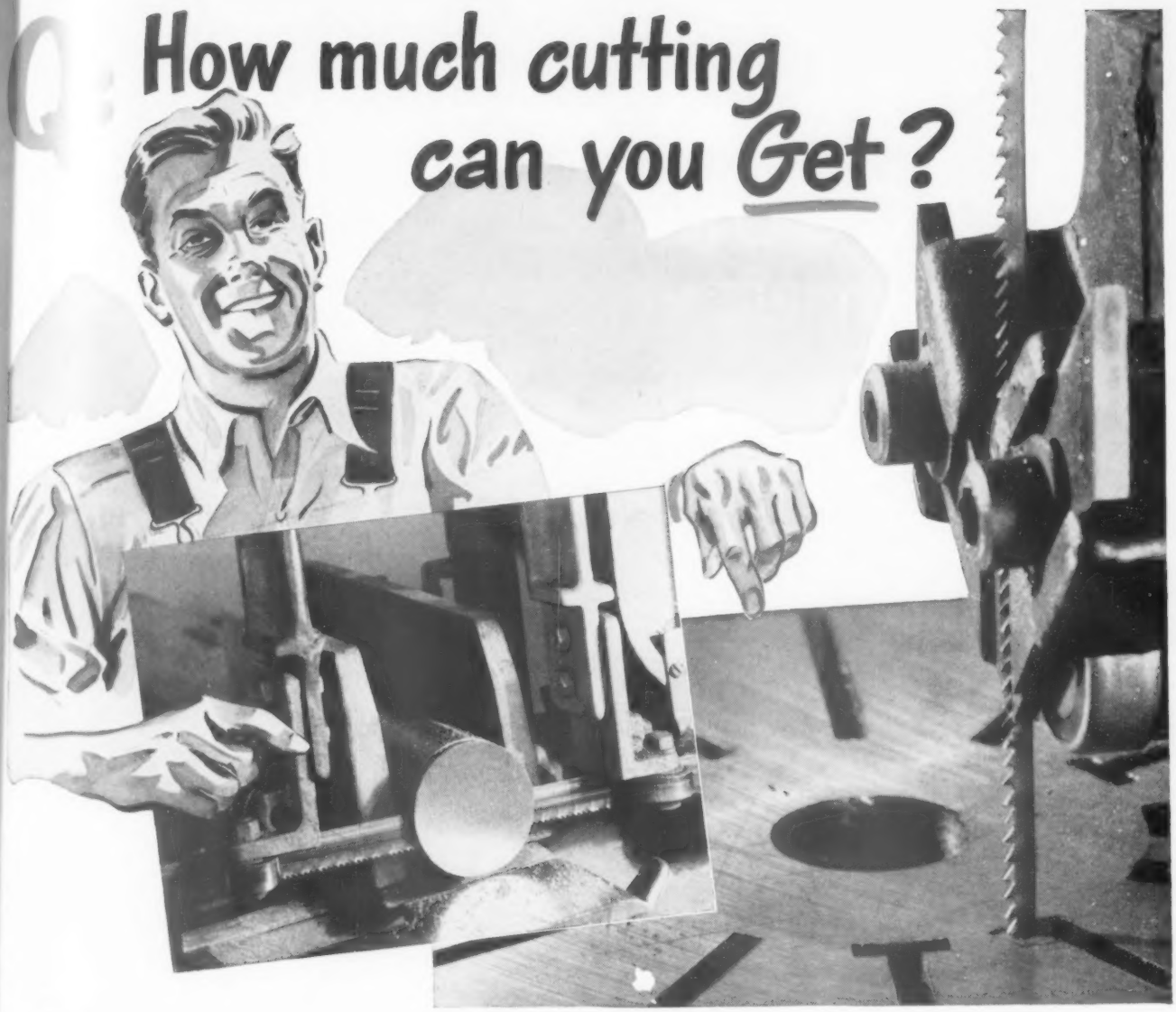
COMPLETE MACHINES — "Hy-Power" work units are easy to apply and use in machines of your own design or construction. Hannifin also offers a complete line of standard and specially designed units to meet users particular requirements.

ASK FOR NEW BULLETIN No. 150

HANNIFIN CORPORATION
1119 So. Kilbourn Ave., Chicago 24, Illinois

AIR CYLINDERS • HYDRAULIC CYLINDERS • HYDRAULIC PRESSES
PNEUMATIC PRESSES • HYDRAULIC RIVETERS • AIR CONTROL VALVES

Q: How much cutting can you Get?



A: Get SIMONDS Metal-Cutting Band-Saws... and find out!

No matter what kind of tough cutting job you're up against, you can't beat these bands for long, trouble-free service. Uniform tooth-set and temper assure fast, smooth cutting. And longest saw-life is assured by special heat-treatment of the back of the saw in order to prevent stretch, weaving in the cut, and cracking of gullets.

Simonds Metal-Cutting Band Saws are furnished with *Standard Tooth* (regular or wavy set) . . . and *Skip Tooth* for cutting plastics, wood, aluminum, and other soft materials. All widths are now packed in handy 100′ containers, and in coils of 300′ . . . or welded to exact machine-length. Get delivery from stock from your local Simonds Distributor . . . call him today.

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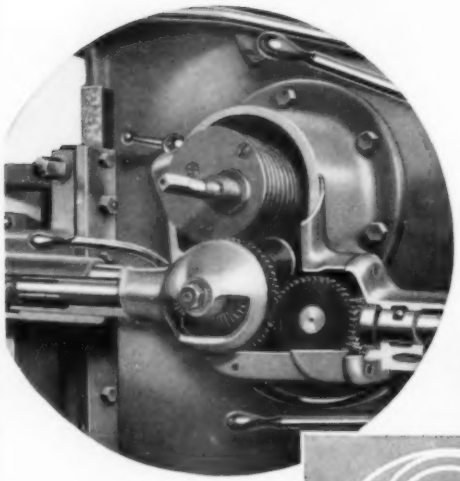
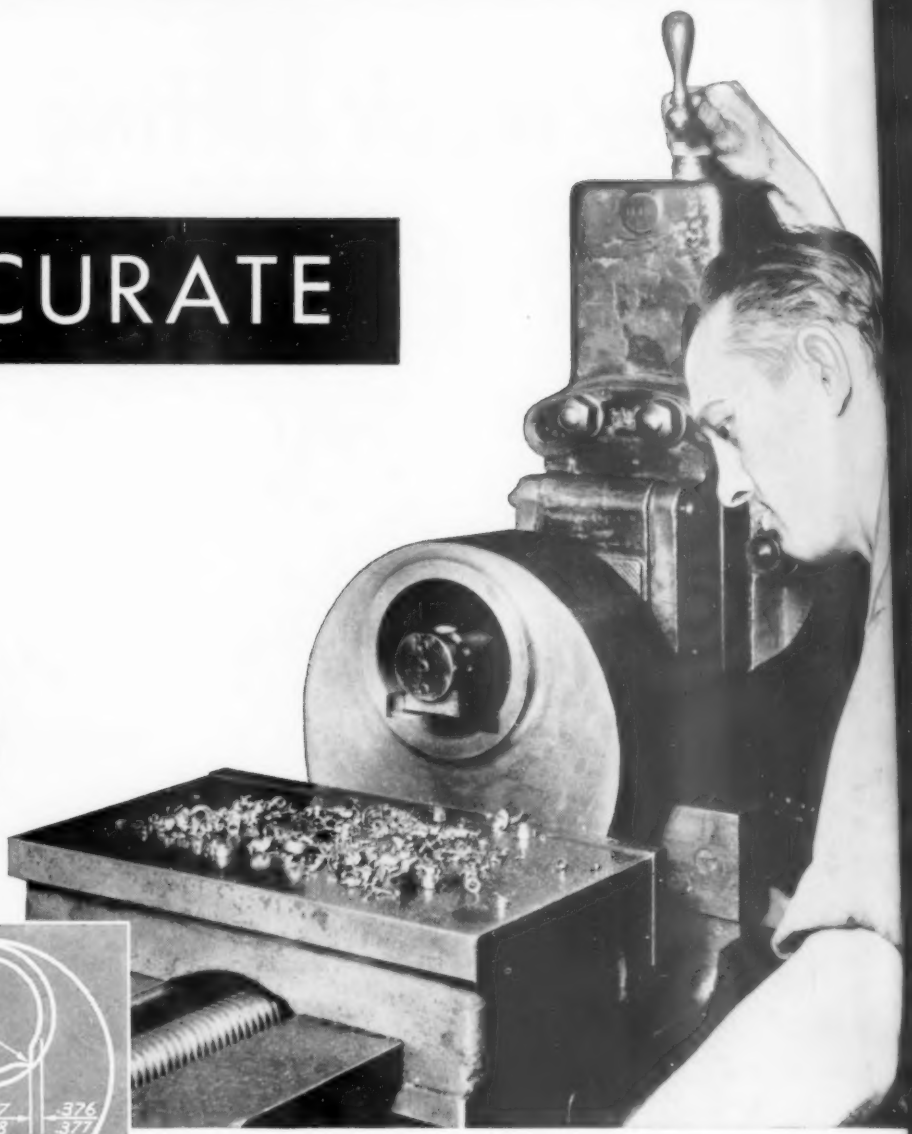
SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

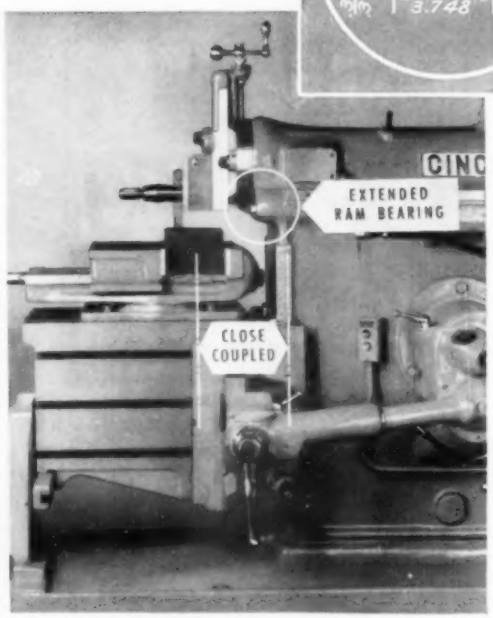
ACCURATE



Exclusive Cincinnati Feed Mechanism



Shaping internal keyways to close limits.



Tool has cut seven inches, and ram has not moved beyond bearing support.

ACCURATE FEEDING

No bumps, no gaps in the feed on a Cincinnati Shaper. The unique feed mechanism, with a cam for each feed always in contact with the follower, maintains both accuracy and a superior finish to the work.

ACCURATE CUTTING

To further increase accuracy, a Cincinnati Shaper literally hugs the work. Extended ram bearings and full table clearance keep the work close to the column, reduce vibration and deflection, and consequent inaccuracies. A Cincinnati Shaper is the closest coupled shaper in the field.

For dependable, day in, day out accuracy, investigate a Cincinnati.

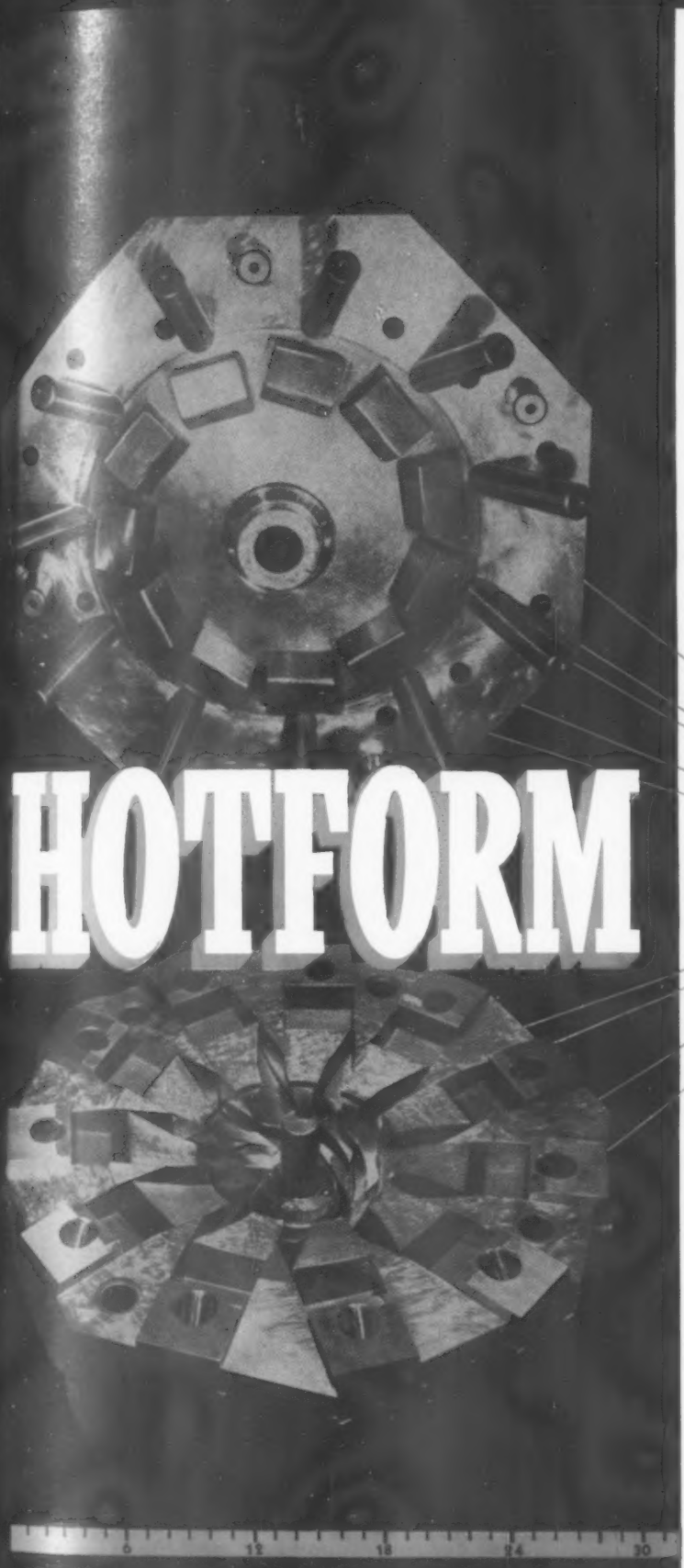
Write for complete Shaper Catalog N-5.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A.

SHAPERS · SHEARS · BRAKES

A

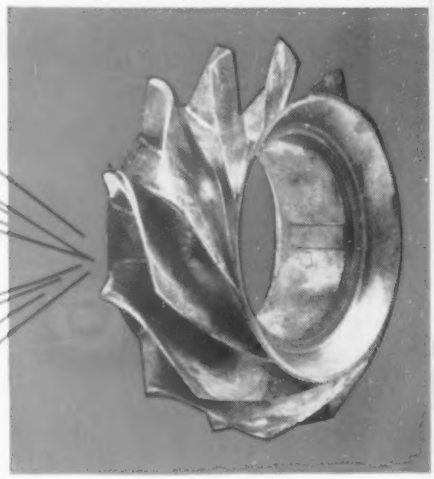


HOTFORM is also available in drill rod and centerless ground sizes for ejector pins and cores.

picked

for performance

in a great new automotive drive!



These beautiful impeller die casting dies for an outstanding automatic transmission are made of HOTFORM—because HOTFORM assures maximum die life and can be relied upon not to crack or show movement in heat treating, even in large and complex shapes. In this exacting application, die movement is stated to have been held within .002". ● Your next tough application merits HOTFORM. Let us discuss it with you!

FIRST QUALITY TOOL STEELS

Vanadium-Alloys
STEEL COMPANY
LATROBE, PENNA.

Colonial Steel Division — Anchor Drawn Steel Co.

High-production set up to drill 19 holes in 5 sides of pump housing at the Heil Co, Milwaukee. 8 17" Drill Press heads (5 standard 2-spindle heads, and 2 with special 3- and 5-spindle heads) mounted on a special table with suitable controls make up this low-cost machine.

DELTA
MILWAUKEE

Delta® Drilling from every Direction!

Build your own special equipment at low cost around Delta accuracy and flexibility!

Delta 17" Drill Press

Complete selection to meet every need — with the right chuck capacity, the right speed . . . in floor and bench types . . . single spindles, multi-spindle batteries, individual heads for special set-ups . . . power-feed — and a complete line of accessories for every model. The same selection in 14" drill presses. All told, 144 different models at prices from $77.50 to $2,893.50.

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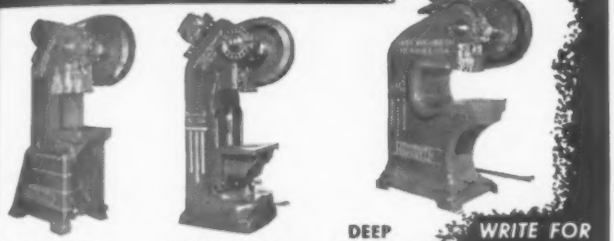

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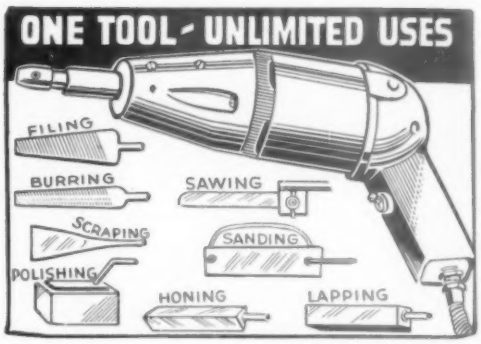

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WHAT'S THE FASTEST WAY TO CLEAN METAL?
See page 11
WHAT'S THE MOST ECONOMICAL WAY?
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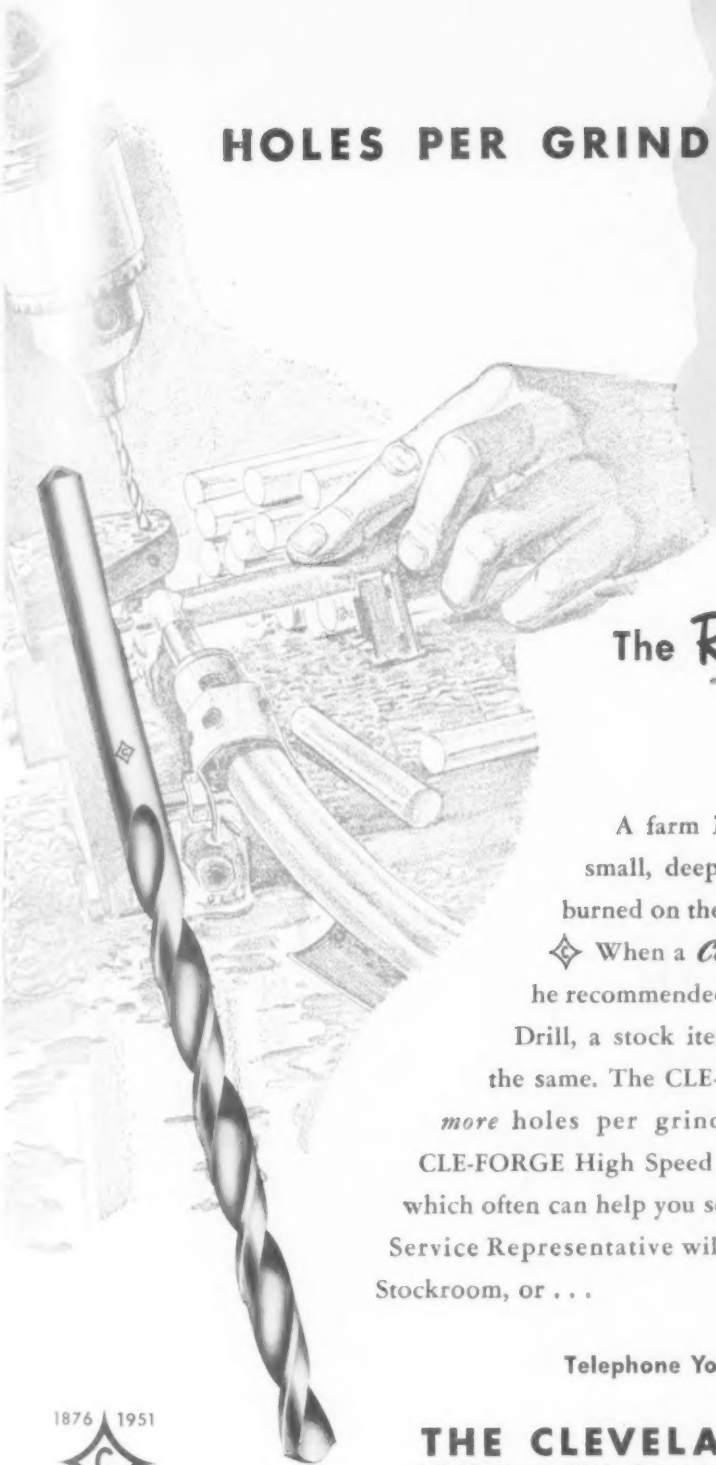

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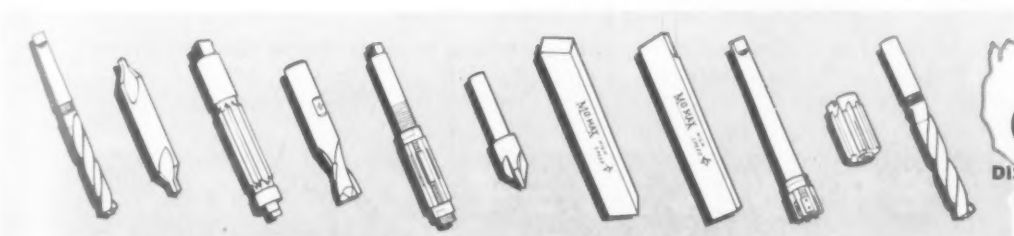

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Now available for oil hardening in entire range of thicknesses...

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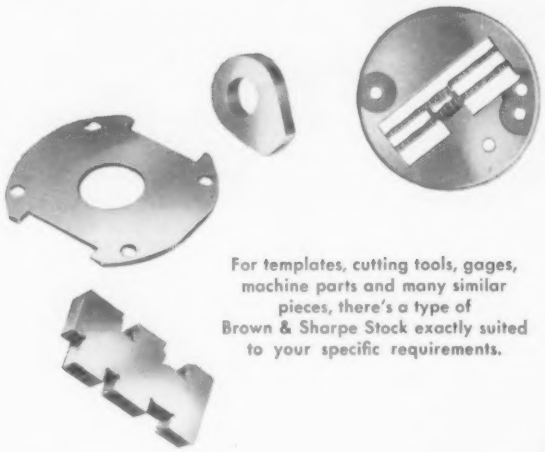

For templates, cutting tools, gages, machine parts and many similar pieces, there's a type of Brown & Sharpe Stock exactly suited to your specific requirements.

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With this complete range of 145 stock sizes, you can meet a wide variety of requirements. Stock for oil hardening is for parts with intricate sections, sharp corners or abrupt changes in form . . . for water hardening, where slightly higher hardness is needed.

Continuous, repeat markings of type on each piece of Brown & Sharpe Ground Flat Stock make identification easy. Protective envelopes in different colors simplify handling.

Write for new descriptive folder. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

We urge buying through the Distributor

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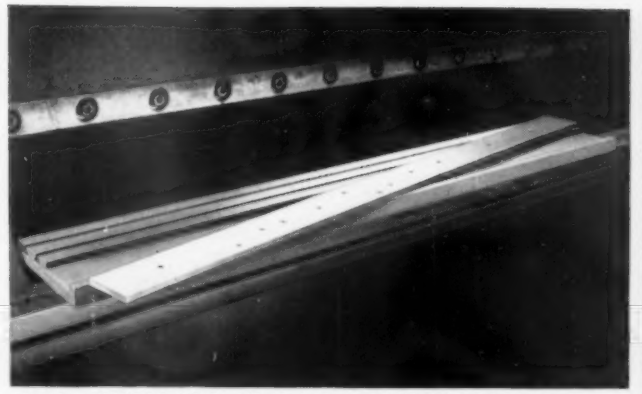
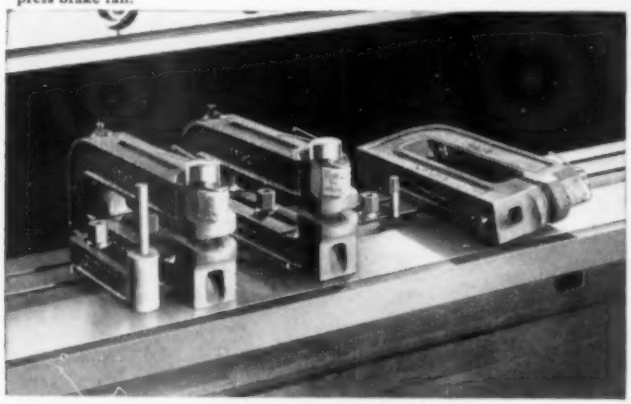
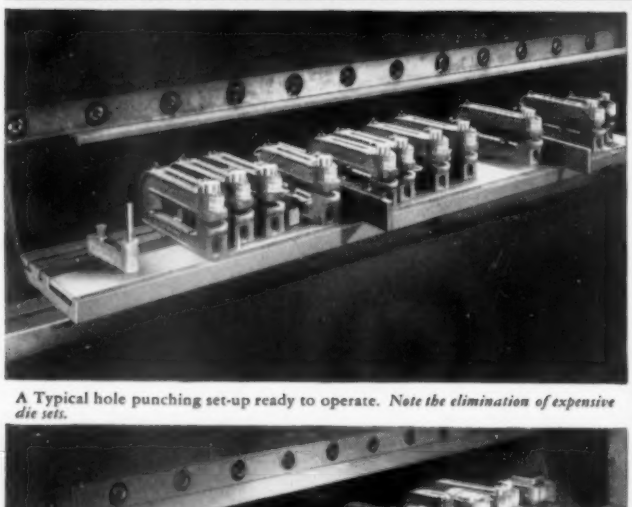


Showing a Wales "Strip" Template laying across the Bed Rail. Note the hole pattern in the template for the pilot pins in the independent, self-contained Wales Hole Punching and Notching Units. This template fits into the channel in the press brake rail.



Showing an End Stop and two Wales Type "BL" Hole Punching Units set up on a "Strip" Template in the Bed Rail. The third Unit is ready to be bolted down.



A Typical hole punching set-up ready to operate. *Note the elimination of expensive die sets.*

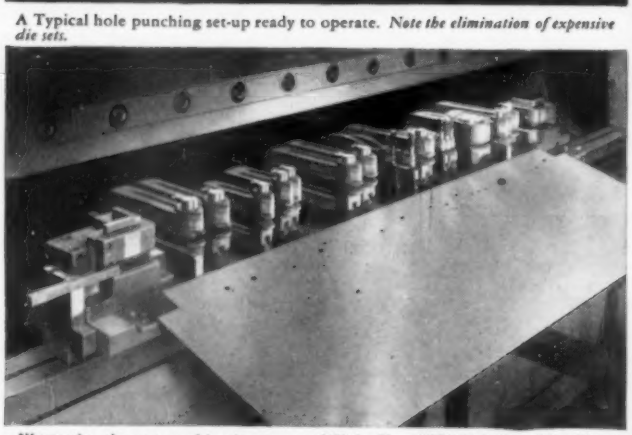


Illustration shows a combination set-up of Wales Type "BL" Hole Punching Units and Type "N" Notching Units with work in foreground.

You don't need expensive die sets with WALES HOLE PUNCHING & NOTCHING UNITS

● The exclusive Wales "Strip" Template Mounting Method for press brakes provides faster set-ups, reduced press "down-time" and easier storage of templates,— all *without the use of die sets.*

As shown at the left, this Mounting Method is made in 2 parts — (1) the Bed Rail and (2) the "Strip" Templates that fit into the bed rail channel. In this way, the Bed Rail remains in the press and the "Strip" Templates are interchanged for unlimited set-ups.

The hole locations are drilled and reamed in the "Strip" Templates for the pilot pins that are concentric with the punches and dies in all Wales independent, self-contained Units. In many cases, holes for several set-ups may be drilled in one "Strip" Template. The press ram does not have to be adjusted between set-ups due to the uniform shut height of Wales Hole Punching and Notching Units. In addition, the same group of Units may be used on an unlimited number of "Strip" Templates.

THE MULTIPLE SAVINGS IN TIME AND INVESTMENT with Wales Equipment is too BIG a story to tell in this space, so write for fully-illustrated, functionally-colored Catalog BL and Catalog N *today*.

WALES-STRIPPIT CORPORATION
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Specialists in Punching and Notching Equipment

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■ Oilgear Broaching Machines have been used by the Western Electric Company plants for many years . . . in some cases as far back as 1928. This great telephone and communications equipment manufacturer uses Oilgear Horizontal and Vertical Broaching Machines for finishing many delicate precision parts that go into telephone exchange assemblies.

In the scene above, three Oilgear single slide vertical surface broaching machines are used to finish various types of magnetic core pins. The first two machines finish broach two flats and a groove on 4 pins per cycle. Production on each machine is in excess of 1600 pieces per hour. The third machine broaches on each pass four 23/32" flats which have been butt-welded to round pole pieces. Production is better than 400 pieces per hour.

Oilgear Broaching Machines have many features which are available only on Oilgear Machines *at no extra cost*. Here are some of these features. Oilgear two-way reverse flow variable delivery pumps have an efficiency of 90% at full load. You get higher, independently adjustable, cutting and return speeds, and positive broaching speed up to 150% overload. The patented electro-hydraulic control is integral with the pump and eliminates valves and piping. Power is *saved* because power is *used* only in proportion to the load . . . because power is reclaimed on return stroke . . . because there are no valves to waste power. The Oilgear system is a simple system. It uses less piping, is accessible yet compact. Wider slides and tables on Oilgear Machines allow broaching of 2 or more parts per cycle. Oilgear also has longer tool slides, and longer ways. Pre-loaded work tables offer closer broaching tolerances and smooth, harmonic operation. For further information, write: THE OILGEAR COMPANY, 1573 W. Pierce St., Milwaukee 4, Wisconsin.

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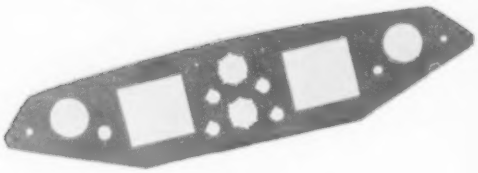

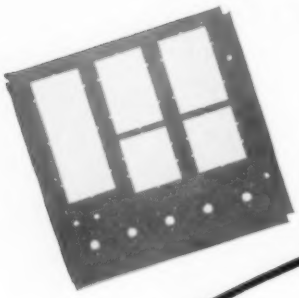

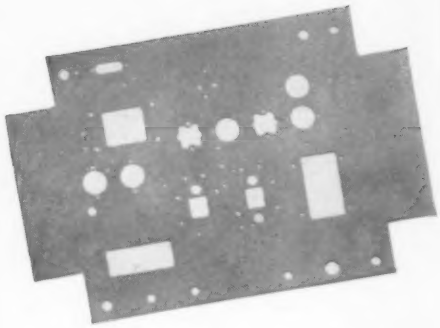

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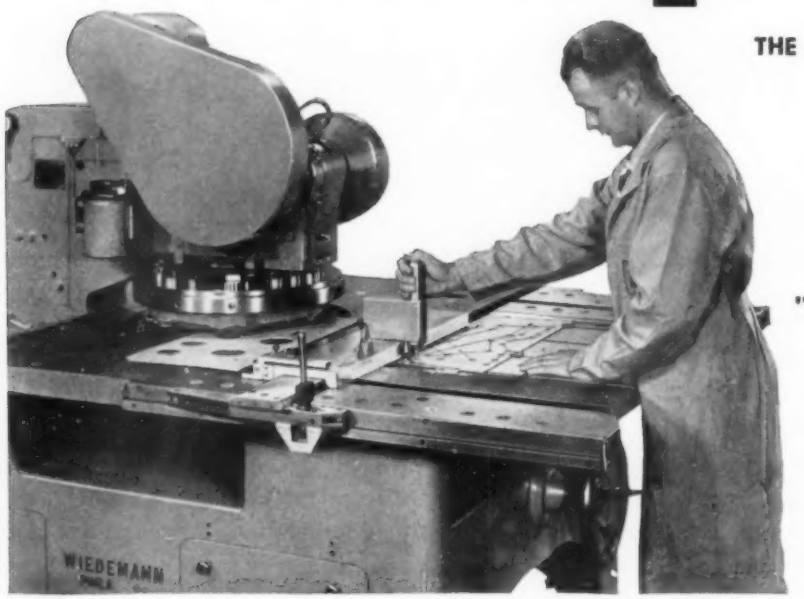
Bulletin 241 describes the most efficient method of producing chassis and similar work in short runs and semi-production runs. Repeat runs of 5 to 1,500 pieces and single runs of 50 to 5,000 pieces are economically produced on the Wiedemann RA-41P. Write today for bulletin 241.



THE WIEDEMANN METHOD permits you to: (1) Keep up with engineering changes without materially affecting production schedule; (2) Keep tool inventory low; (3) Produce quantities in accordance with sales requirements; (4) Produce accurate work with inexpensive tools.

"THE WIEDEMANN METHOD" through the elimination of expensive punch and die set-up and work location methods, provides an efficient means of piercing single pieces, and semi-production runs, regardless of repeat frequency.

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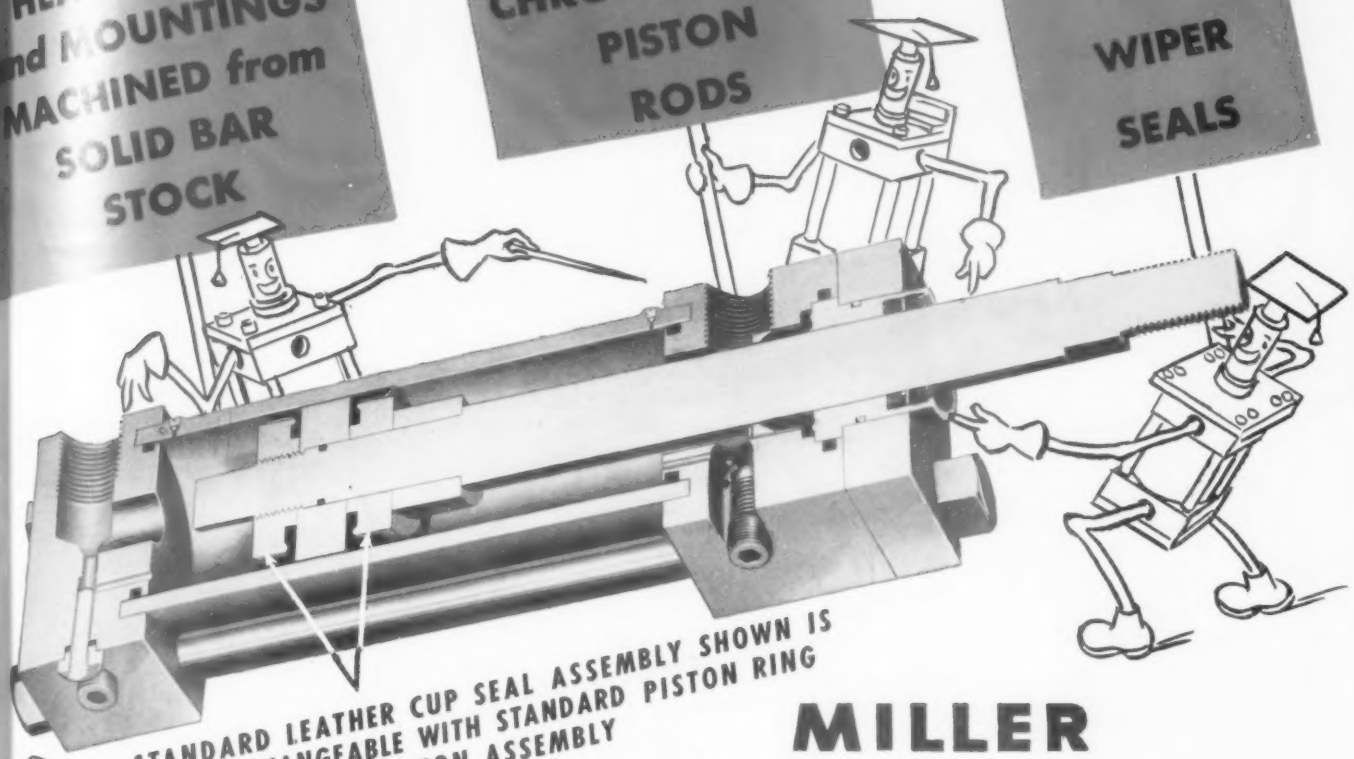

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Meet J. I. C. HYDRAULIC STANDARDS

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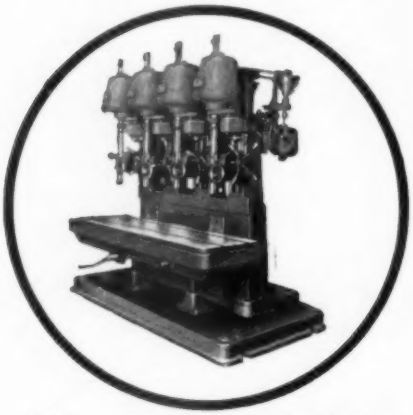
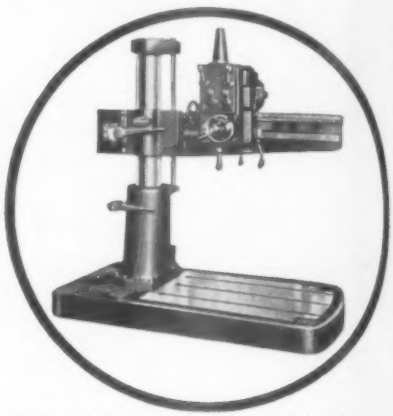
21″ Box column sliding head floor drill, single spindle. Bulletin 100A.

16″ Box column sliding head bench and floor drill, single spindle. Bulletins 155V, 119, 215.

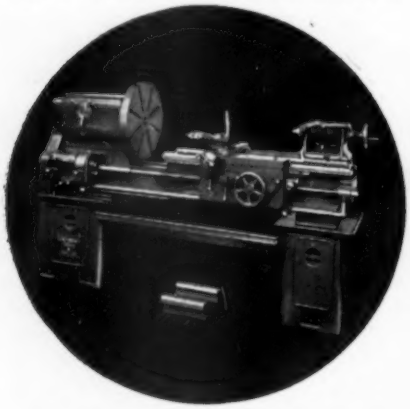


21″ Box column sliding head floor drill, multiple spindle. Bulletin 100A.

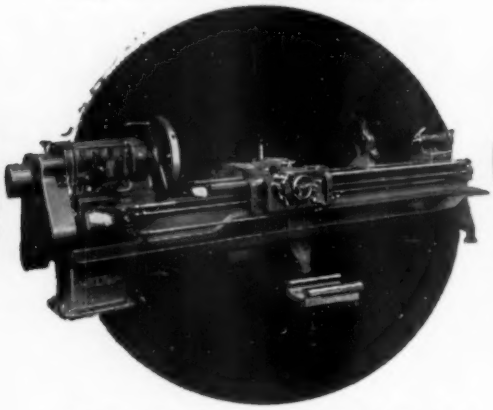
18″ Royal sensitive bench and floor drill, single and multiple spindle. Bulletin 218.



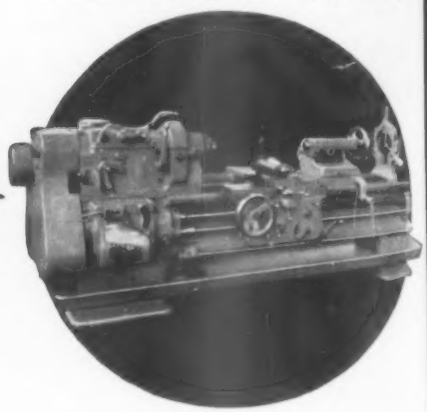
Radial drills—3′, 4′, 5′ arms; 7″, 9″, and 11″ columns. Bulletins 116 and CO-15.



Tray-top fixed gap bed Engine Lathes —15 & 18 swing sizes. Bulletin T-100-4



Standard fixed gap bed Engine Lathes—14, 16, 18, 20, 22 & 24 swing sizes. Bulletin S-101



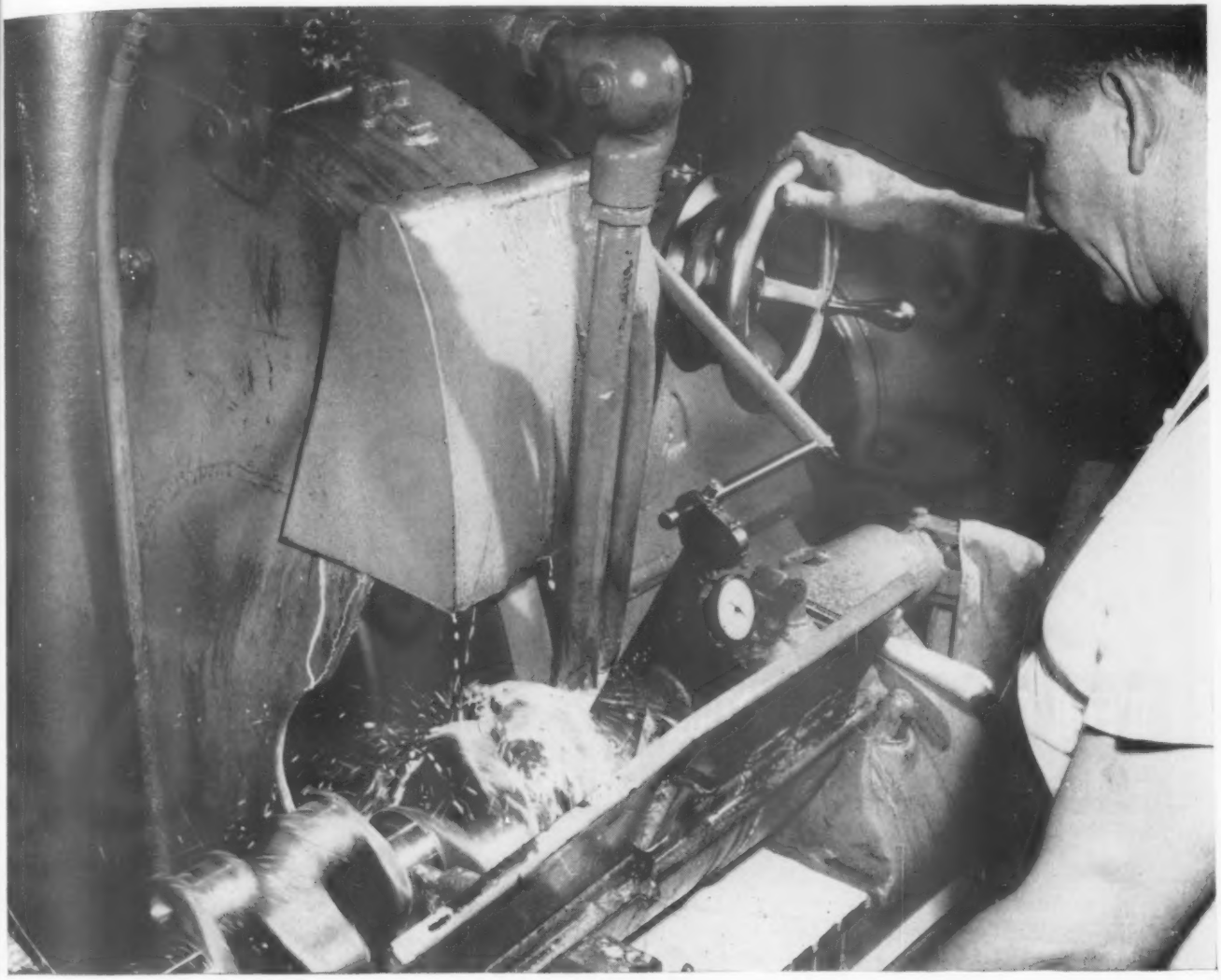
Standard Engine Lathes—14, 16, 18, 20, 22 & 24 swing sizes. Bulletin S-101

Tray-top Engine & Toolroom Lathes—10, 12½, 15 & 18 swing sizes. Bulletin T-100-4

plus value

High productivity, versatility, and money-saving features you normally find only on expensive drilling machines and engine lathes are standard equipment at no extra cost in the famous Cincinnati and Canedy-Otto lines. For example: Cincinnati Tray-Top all-geared head light duty engine lathes have 12 spindle speeds, 48 thread and feed changes, extra large spindles, totally enclosed quick change gear box, quickest and easiest changeover from English to metric thread chasing, and many other valuable features. All machines in these lines are backed by a leading name in machine tool manufacture: The Cincinnati Lathe & Tool Co., Cincinnati 9, Ohio.

cincinnati lathe & tool co.



If a belt could do it better...

Grinding a crankshaft calls for a grinding wheel of definite specifications. But, if it could be done better, faster or more economically...with an abrasive belt, for instance... CARBORUNDUM would be free to recommend the *right* belt impartially. This is because only CARBORUNDUM manufactures a *complete* line of abrasives —and only CARBORUNDUM can make impartial recommendation of the *right* abrasive to use in every grinding or cutting operation.

By standardizing on abrasives by CARBORUNDUM you get the benefit of technical advice on abrasive product use and latest developments in abrasives, without regard to production "limitations" in the abrasive field.

Only CARBORUNDUM
TRADE MARK

makes ALL abrasives to give you the proper ONE

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company, Niagara Falls, N. Y.

Talide
(TUNGSTEN CARBIDE)
MEETS EVERY REQUIREMENT

METAL CARBIDES CORPORATION
YOUNGSTOWN 7, OHIO
SINTERED CARBIDES—HOT PRESSED CARBIDES

USE READER SERVICE CARD; INDICATE A-2-114-1

WANTED *Most* FOR HIGH ACCURACY STAMPING OPERATIONS

V&O
LONG SLIDE *Precision* POWER PRESSES

Faster stamping operations . . . longer die life assured by many advanced engineering features —*including the exclusive V&O long slide for accurate guiding.* Made in sizes from 3 to 105-ton capacity—inclinable type.

WRITE FOR CATALOG

THE V&O PRESS COMPANY
DIVISION OF HARTFORD-EMPIRE COMPANY
Builders of Precision POWER PRESSES and FEEDS
Since 1889 **HUDSON, N.Y.**

USE READER SERVICE CARD; INDICATE A-2-114-3

Machine de-burring with NOBUR *pays BIG production dividends!*

NOBUR Tools *turn a slow bench operation into fast and efficient machine work!* Remove burrs on multi-walled parts with a smooth, clean cutting action that won't mar highly finished surfaces. Eliminate rejects from slow, costly hand work with files, scrapers and abrasives.

Nobur Tools are used on any lathe, drill press, portable drill or flexible shaft. Operation of the double-edge cutting blade is easy and safe . . . no skilled help is required, and the spindle *never needs to be stopped* for either de-burring or chamfering.

Nobur Tools cut freely on either hard or soft metals, are simple in construction and are made in sizes to cover a full range of hole diameters. ***NEW "DS" SERIES extends range of NOBUR applications to holes as small as 1/8" diameter. WRITE FOR FULL DETAILS TODAY!**

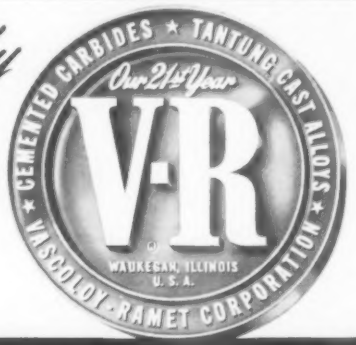
Parts like these quickly de-burred with

NO BUR TOOLS

NOBUR MANUFACTURING COMPANY
717 N. VICTORY BLVD., BURBANK, CALIF.

USE READER SERVICE CARD; INDICATE A-2-114-2

Specify
CEMENTED CARBIDES ★ TANTUNG CAST ALLOYS

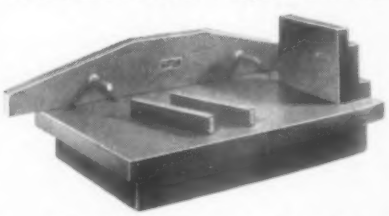


VASCOLOY-RAMET CORPORATION
WAUKEGAN, ILLINOIS

USE READER SERVICE CARD; INDICATE A-2-114-4

A COMPLETE LINE OF BASIC
PRECISION INSPECTION EQUIPMENT

RAHN BLACK GRANITE
ACCURACY TO .00005"

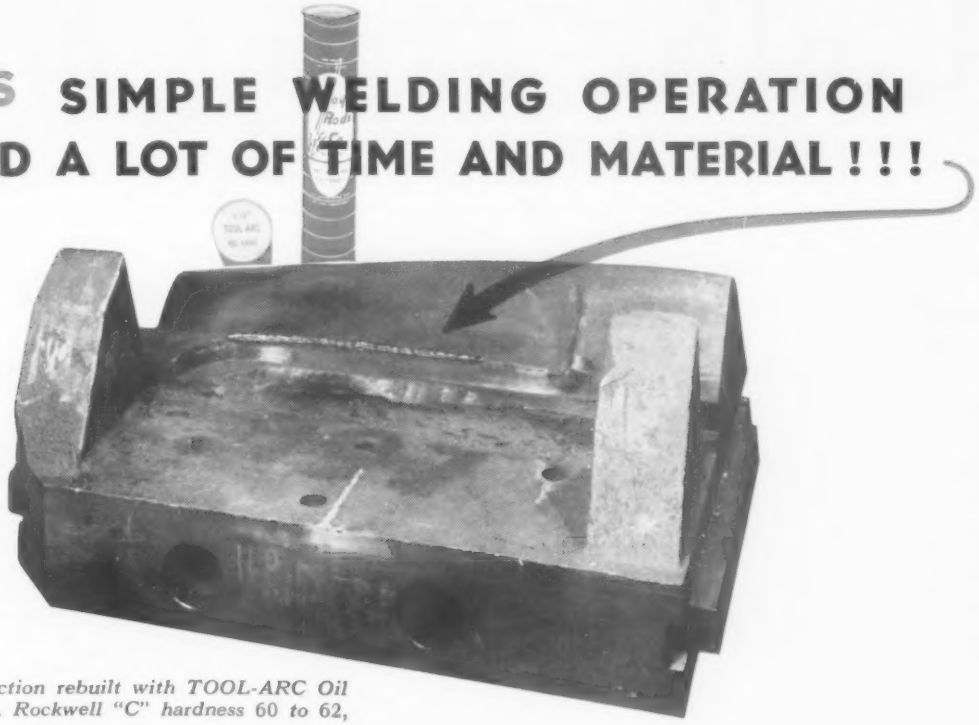


SURFACE PLATES — ANGLE PLATES — PARALLELS — STRAIGHT EDGES
Warp-free, Rust-free, Bump-free, Extra Hard, Super Smooth

FREE TRIAL! RAHN GRANITE SURFACE PLATE CO.
641 N. Western Dayton 7, Ohio

USE READER SERVICE CARD; INDICATE A-2-114-5

THIS SIMPLE WELDING OPERATION SAVED A LOT OF TIME AND MATERIAL ! ! !



Male flanging die section rebuilt with TOOL-ARC Oil Hardening electrodes. Rockwell "C" hardness 60 to 62, as welded.

TOOL-ARC Conserves Material, Saves Manhours Minimizes Production Delays . . .

Six Basic Types

TOOL-ARC
Oil Hardening
TOOL-ARC
Water Hardening
TOOL-ARC
Air Hardening
TOOL-ARC
Hot Work
TOOL-ARC
High Speed
TOOL-ARC
Work Hardening

TOOL-ARC electrodes are made by the extruded process to assure uniform coating thickness concentric with the core wire. Result — finer quality weld with greater dependability. These electrodes will deposit tool steel weld metal of any one of six basic types and provide characteristics typical of each type.

FOR:
- Engineering Design Changes
- Rebuilding Worn Tools and Dies
- Composite Fabrication of New Dies

Prolong the life of your tools and dies by refacing with TOOL-ARC. For complete description, properties and welding procedures, ask for Bulletin No. 2519.

"I Like the rod that comes in the RED can"

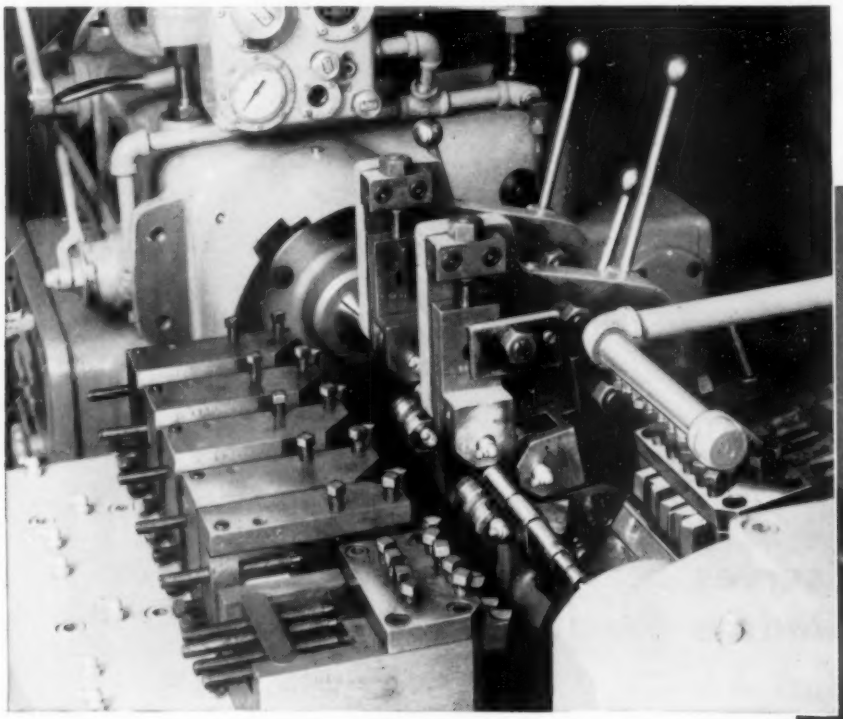
SEE YOUR NEAREST ALLOY RODS DISTRIBUTOR

ARCALOY for stainless steel
NICKEL-ARC for cast iron
TOOL-ARC for tool steel
WEAR-ARC for hard facing
BRONZE-ARC for general use

ALLOY RODS CO. York, Penna.

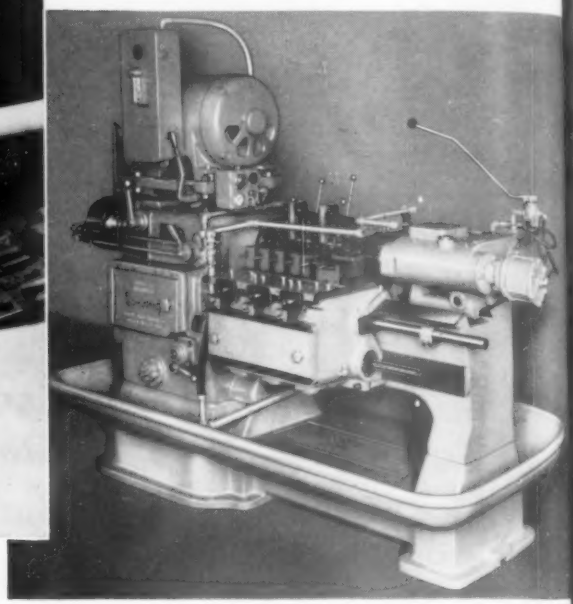
MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YO



Left: Closeup view of tooling and steady rests.

Below: Model LR Lo-swing Lathe equipped for machi spinning rolls.



MODEL LR Lo-swing LATHE SPEEDS SPINNING ROLL PRODUCTION

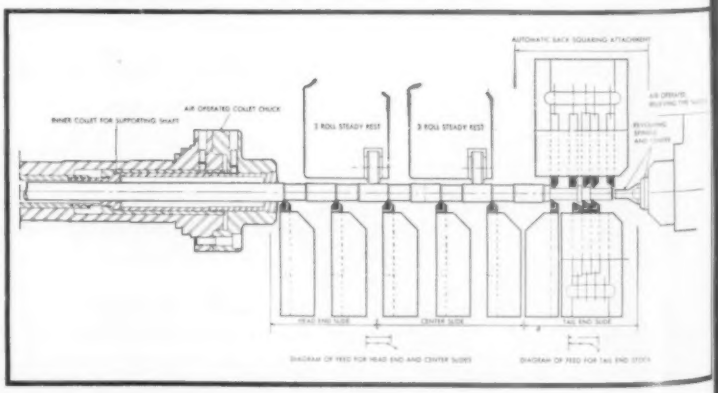
Problem: To turn and face long spinning rolls within close tolerances.

Solution: The Model LR Automatic Lo-swing Lathe selected for this job was equipped with a hollow spindle to permit one-half of the spinning roll to extend into the spindle. This method increased the rigidity of the work and assured closer machining tolerances. The upper right illustration shows the lathe equipped for the first turning operation. Note the relieving type tailstock which swings on hinged joints to facilitate loading work into the collet chuck. The upper left illustration is a closeup view of the tooling and steady rests.

The spinning rolls are turned from ground stock, properly centered on each end. They are supported by the collet chuck, two 3-roll rests, and a tailstock center, as shown in the tooling layout below. This method holds the work very rigidly and assures the close tolerances specified on the turned diameters.

The entire operation is automatic; the operator simply places the roll in position and locks the steady rests on the previously ground bar stock. The machi cycle is then started and continues automatically un all diameters are turned and faced, and the tool slid returned to the starting position. A similar machi and tooling is used for machining the opposite end the shaft.

Let Seneca Falls engineers assist you with your turni problems.



SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

GREATER MACHINE SPEEDS, LONGER TOOL LIFE, LOWER PRODUCTION COSTS

Lusol THE NEW COOLANT

THAT HAS REVOLUTIONIZED PRODUCTION THINKING

10 MILLION GALLONS OF PROOF

The use of 10 million gallons of Lusol solution in exhaustive testing and in everyday plant applications lies behind the extraordinary claims we make for this extraordinary coolant. It has revolutionized the ideas of some of the country's most critical production experts on the subjects of machine speeds, tool life and production costs. These men demanded proof and got it.

SPEEDS INCREASED UP TO 400%

Lusol affords such efficient cooling at the point of tool contact that it has made possible up to 300% to 400% greater speeds, and at the same time less tool wear, less tool breakage, finer finish and greatly increased production. One case, for example, a bar of 18.8 stainless steel was being cut in 20 minutes. Lusol was then used. Speeds were increased from 30 RPM to 267 RPM and the bar was cut in 2 minutes. On this job tools had been breaking frequently. After shifting to Lusol, tool breakage has been reduced to zero. This is just one case, but it is typical of the results that make Lusol hard to compete with.

WHY OPERATORS LIKE LUSOL

Lusol offers the operator many advantages. In the first place it is clear and clean, mild as a soap solution, and not irritating to the skin. Clothes and shoes are kept cleaner and the whole shop takes on a new look. It helps keeps the machine clean, and a good operator appreciates this; and, very important, it is a clear solution that allows the operator to see the work as the finest drill comes down to the work piece. This means more perfect vision at the critical point so often blurred by old type coolants. On top of being pleasanter and easier to work with, Lusol means fewer tool changes, less wheel dressing, far greater speeds, and more efficient production.

SAVINGS YOU CAN'T AFFORD TO MISS

If you are machining, milling, boring, broaching, tapping, drilling or grinding, you cannot afford to disregard the savings that Lusol has made possible for others (perhaps your competitors) whose production involves these operations. Look at these figures "275% greater production per broach grind," "Saved 90% drills, 75% taps," "Over 200% more pieces per wheel dressing." These are facts. They are proof of the type of result Lusol is achieving and can achieve for you.

PROOF THROUGH CASE HISTORIES

BROACHING

266% greater production per broach grind

AMERICAN HORIZONTAL BROACH
Metal: Steel forging
Operation: Broach clutch hub. Broach and work ran hot requiring a *shutdown every 2 hours* for cooling when ordinary cutting oil was used. Changed to Lusol and ran 8 hrs. continuously. Tool and work remained cool.
Ordinary Cutting Oil — 2100 pieces per broach grind.
Lusol — 7700 pieces per broach grind.

TAPPING

Tap life increased 1300%

LEES SPECIAL TAPPER
Metal: No. 1008 Steel.
Operation: Tap ¾" — No. 11 1" through an 11/16" drawn hole at 120 SFPM.
Ordinary Cutting Oil: 30 pieces per tap.
Lusol: 420 pieces per tap.

GRINDING OPERATIONS

Grinding time reduced 25%

LANDIS EXTERNAL GRINDER
Metal: CN Steel.
Operation: Step roll grind to 4 diameters; 1-6" r, 1-9" r, 2 rt. angles removing .015"-.030" of metal.
Ordinary Soluble Oil: Grinding time 8 hours.
Lusol: Grinding time 6 hours.

CASE HISTORIES YOU CAN'T AFFORD TO OVERLOOK

Lusol

AVES TOOLS ▼ SPEEDS WORK
CUTS COST

ATIONAL DISTRIBUTION . . . WAREHOUSE STOCKS

F. E. ANDERSON OIL COMPANY
224 Brownstone Ave., Portland, Conn.

Please send me your case history material on:
☐ Broaching ☐ Drilling, Tapping ☐ Grinding

Name
Company
Address

REMARKABLE STABILITY

.003" RANGE

ACTUAL SIZE
9" x 7⅜" x 8½"
WEIGHT 17¾ LBS.

New FEDERAL Air Gage!
The DIMENSIONAIR!
Use it under oil or coolants!

EXCEPTIONAL MEASURING RANGE .003" — *three times more* than that of any gage heretofore. You can determine the size of a hole long before it reaches the size required. The greater range now permits gaging irregular and tapered holes formerly impossible to measure.

STABILITY IS UNEQUALLED — no drift of the indicator hand; hours — days — or weeks after. The jeweled meter is cushioned at both ends to eliminate damage. No sticking.

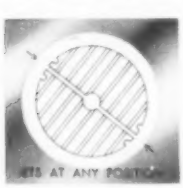
POSITIVE INDICATOR SETTING in a few seconds — simplest of all to set up. No master jet adjustment.

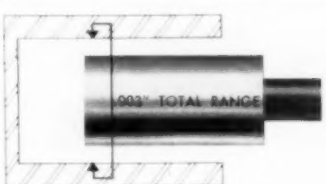
IT READS .00005" *directly*. Not a "go — no go" gage. Only one master required. Tolerances are set up on the dial directly just as on a Dial Indicator. Insert plug in hole with jets at *any position*.

ANY PRESSURE FROM 40 TO 100 POUNDS. Normal pressure fluctuations do not affect its accuracy. Smallest centralizing error of any air gage.

USE IT UNDER OIL OR COOLANTS. Greater jet pressure, larger orifices and *extra clearance* enable the plug to be used at production. Grit, dirt, and rough handling won't interfere or clog it.

DEEPER RECESS CLEARANCE — chrome plated plugs — longer wear; finger-tight hose and plug connections; non-corrosive, vinylite plastic hose; and many other outstanding performance features make the Federal Dimensionair an air gage which will pay off in better, more positive gaging. Write for a free demonstration. You owe it to yourself to see the Dimensionair. FEDERAL PRODUCTS CORPORATION, 1192 Eddy Street, Providence 1, Rhode Island.





Largest manufacturer of indicating type gages . . . exclusively.

USE READER SERVICE CARD; INDICATE A-2-118-1

TRY THIS *simpler way* OF ALIGNING THE WORK WITH THE SPINDLE!

Types to fit any machine used for tapping or reaming.

On tapping and reaming jobs, instead of spending the extra time necessary to make an absolutely accurate alignment of the work with the spindle, why not try this simpler way!

In place of an ordinary tool holder, use a Ziegler Tool Holder. Then all you have to do is align the work with spindle to within $\frac{1}{32}$" radius or $\frac{1}{16}$" diameter, and the Ziegler Holder automatically compensates for the difference.

You'll find that the labor costs saved will reimburse you for the cost of the Ziegler Holder in a remarkably short time and then continue to save you money throughout the life of the holder. Try it and see.

W. M. ZIEGLER TOOL COMPANY
13574 Auburn Avenue Detroit 23, Mich.

Ziegler ROLLER DRIVE **FLOATING HOLDER** *for* Taps *and* Reamers...

WRITE FOR CATALOO

USE READER SERVICE CARD; INDICATE A-2-118-2

---

for Unmatched Values always specify

ACE

FINER DRILL BUSHINGS

Three-fourths Million Standard and Special Size Inventory . . . Highest Quality Steels . . . Perfect Design and Engineering . . . Faster, Reliable Service.

Affiliate member A.S.T.E. Chap. 27

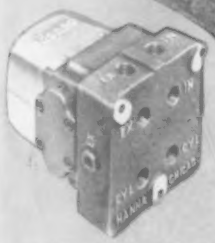
ultra UP precision
THAT EXTRA ACE VALUE

ACE DRILL BUSHING CO.
5401 FOUNTAIN AVENUE LOS ANGELES 27
HOllywood 9-8253

USE READER SERVICE CARD; INDICATE A-2-118-3

VALVES WITH UNUSUAL AND VERSATILE FEATURES . . .

Hanna 4-Way Solenoid Valves



- 4 Sizes—⅜", ½", ¾", 1"
- Solenoid stroke only 5/32"
- Silent operation — Spool stops against Neoprene cushions
- Valve stroke response to push button requires only 1/20 second
- Low current consumption
- Three-point mounting pads
- Valve proper made of corrosion-resistant materials
- Precision-built for lasting service

Lines may be connected to sides, bottom or a combination of both in these versatile single and double Solenoid Valves developed by Hanna. They are balanced spool type—controlled by built-in pilot valve—and are adaptable to straight line piping, with valve capacity equal to rated pipe size.

Other flexible features of the small, compact, 4-way Solenoids include: valve proper may be removed from manifold without disconnecting pipe lines; valves and manifolds are interchangeable; parts are interchangeable; and solenoids may be instantly removed and replaced without breaking wiring connections when a cord with pin plugs is used.

Double Solenoid Valves operate with momentary contact switches, eliminating the need of a holding current. Single Solenoid (Spring Offset) Valves require a holding current. Each has its application.

Hanna Solenoid Valves are designed and built for finest, dependable performance, reflecting the 50 years of Hanna engineering and development of better products for industry.

Send for New Valve Catalog

Hanna Valve Catalog 254 gives more information on Solenoid Valves — and includes details on the complete Hanna Valve line.

50th Anniversary 1901-1951

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

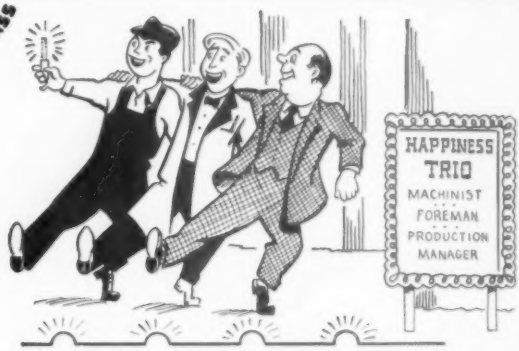
1765 Elston Avenue, Chicago 22, Illinois

There once was a dancer who "tapped" on the stage.
He bucked and he winged to a ripe old age!

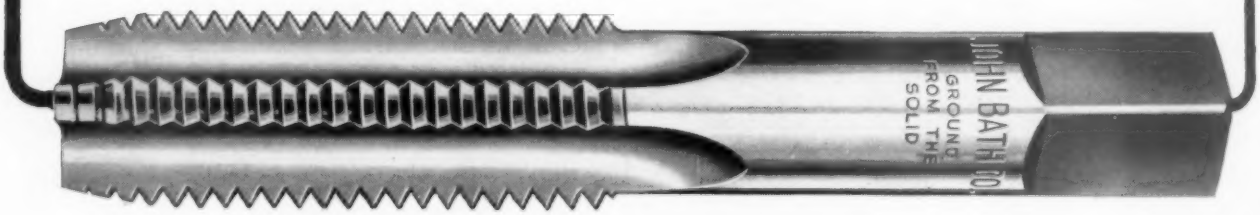
He tapped 'til he "clogged" in bad condition.
And they gave him the "hook" at every rendition!

JOHN BATH CO. INC. · WORCESTER · MASS ·

Some folks run taps too deep and too long.
They'll clog and break and cut threads wrong!



Keep Bath Taps in condition, always on hand.
Your production will be "in step" with the band!



INSIST ON BATH TAPS . . . PROFIT BY THEIR PLUS-PERFORMANCE

When Bath Taps leave our plant, expert workmanship and rigid inspection combine to assure plus-performance in your shop. A special Bath process completely hardens the taps to uniform structure before threading, assuring the accurate performance of a precision tool.

Preserving this efficiency is sometimes sacrificed by the operator who (1) runs the tap until it breaks (2) runs the tap until the cutting edge is too worn for proper reconditioning or (3) does not sharpen the tap properly.

Making a thorough check before every job of the tap style required by the material, of the fixtures and lubrication, will do much to guard against tap and work spoilage . . . will lower the cost per tapped hole. We invite your inquiry on any tap problem . . . ask the Bath representative or write us direct.

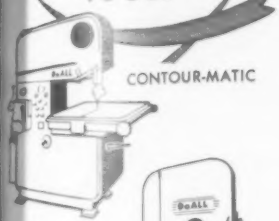
PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

JOHN BATH CO. INCORPORATED

28 Grafton St., Worcester, Mass.

DoALL

INDUSTRY'S NEW SET OF TOOLS



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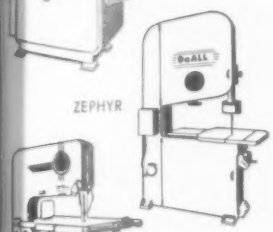
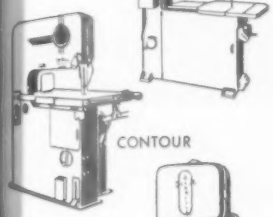
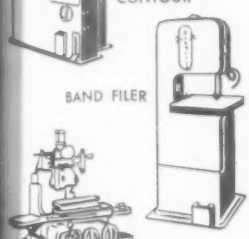


ZEPHYR

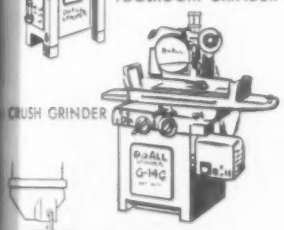


CONTOUR



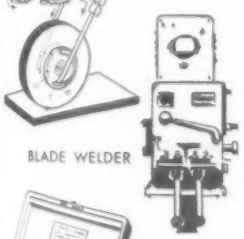
BAND FILER

TOOLROOM GRINDER



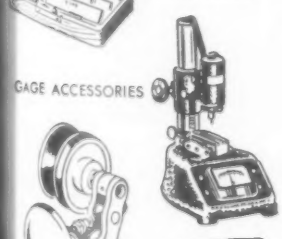
CRUSH GRINDER

"COOL GRINDING" ATTACHMENT



BLADE WELDER

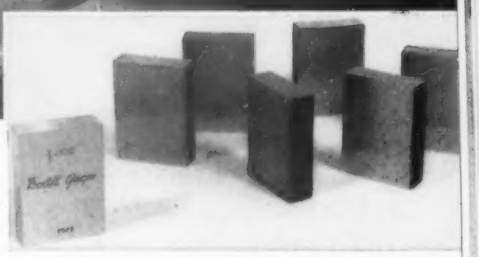
GAGE BLOCKS



GAGE ACCESSORIES

VARIABLE SPEED DRIVES

SAW BANDS



IMPOSSIBLE?

It's easy with a DoALL SURFACE GRINDER!

Problem: Grind a chuck-load of gage block blanks, flat and parallel to .0001" leaving .0001" for lapping. Surface finish must be .000007" RMS or better.

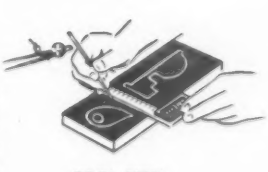
Solution: Use any DoALL Precision Surface Grinder, with "Cool Grinding."

"Cool Grinding" on the DoALL Super Precision Grinder (7 models available).

Precision Grinding is one of the first steps in the production of DoALL Gage Blocks. DoALL Grinders have inherent rigidity, plus a fine spindle and smooth operation that make it possible to finish grind with cuts as deep as .025".

DoALL "Cool Grinding" adds to wheel life and prevents burning of the work.

Let us show you, through actual demonstration, how DoALL Surface Grinders can save you time and money. Write for complete information today.



TOOL STEEL

BENCH FILER

The DoALL Company

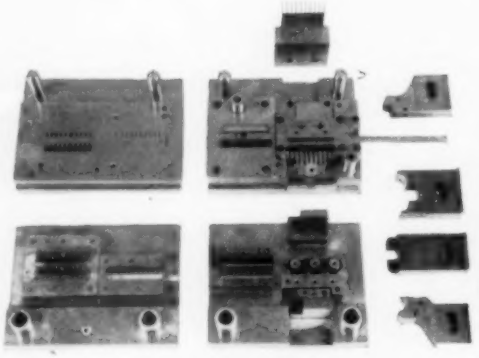
Des Plaines, Ill., U.S.A.

Cable Address: DoALL, Des Plaines

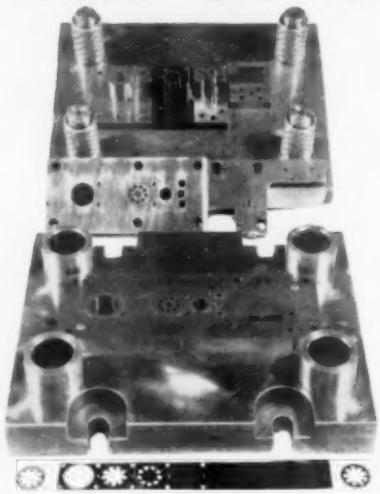
DoAll Stores In Key Cities

Factory Trained Representatives Everywhere

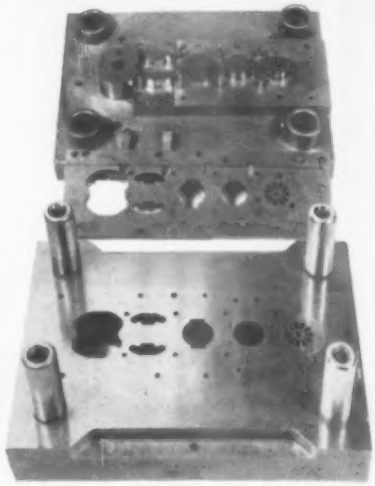
LAMINATION DIES BY COMMANDO



Commutator Die



Built of tungsten-carbide



Built of hi-carbon, hi-chrome
This die has produced 17,500,000 hits, 35,000,000 rotors and stators.

Lamination dies by Commando are giving outstanding performances daily throughout the country. Names of our many satisfied customers will be furnished upon request. If you have a lamination die problem, our precision, segmented, all ground dies should be your answer.

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FOR PRODUCTION HOT WORK—

FORMITE—
Highest Heat Resistance
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High Red Hardness with Toughness
FIREDIE—
Resists Fire Checking
BUSTER ALLOY—
For Lower Heats with Sudden Temperature Changes

COLUMBIA TOOL STEEL COMPANY

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1" COLLET CAPACITY

Handles More Jobs

1" collet and 1⅜" spindle bore give this lathe the capacity for a greater variety of jobs. Its 48 power feeds for turning, 48 for facing and 48 for threading give you everything you need for any job. And its accuracy and rugged construction assure precision work through years of dependable service. *Write for catalog.*

South Bend 10" x 3', 1" Collet Capacity, Quick Change Gear Precision Bench Lathe (illustrated above).

Building Better Tools Since 1906

SOUTH BEND LATHE SOUTH BEND 22, INDIANA

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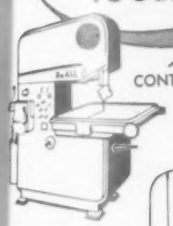
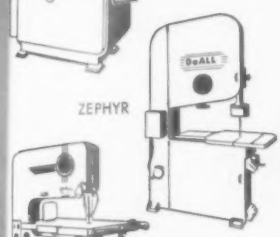
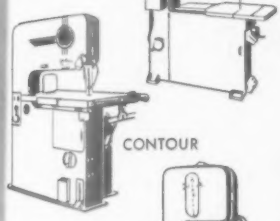
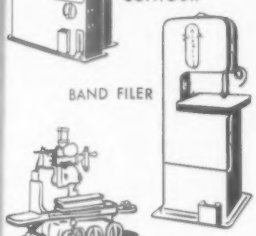
DoALL

INDUSTRY'S NEW SET OF TOOLS

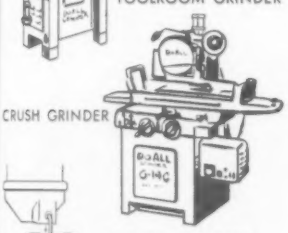

CONTOUR-MATIC


ZEPHYR

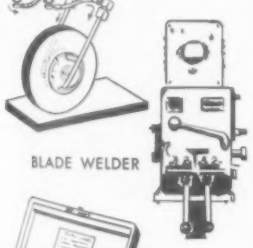

CONTOUR


BAND FILER

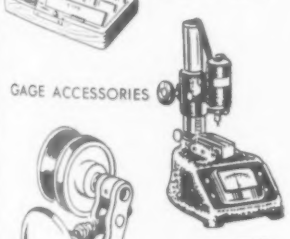
TOOLROOM GRINDER


CRUSH GRINDER

"COOL GRINDING" ATTACHMENT


BLADE WELDER

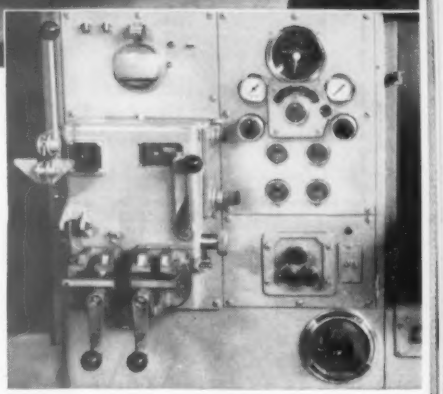
GAGE BLOCKS


GAGE ACCESSORIES

VARIABLE SPEED DRIVES

SAW BANDS

42 HOURS SAVED over any other machining method. This 327 lb. High Tensile Iron Forming Die was band machined on the DoALL Contour-matic.



NEW DoALL Contour-matic IS MORE THAN JUST A MACHINE TOOL

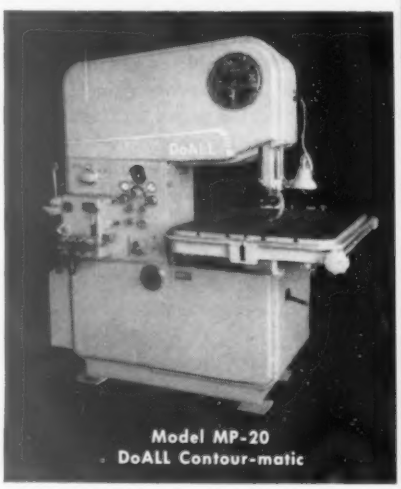
The new DoALL Contour-matic is the first Band Machine that is a true production machine tool.

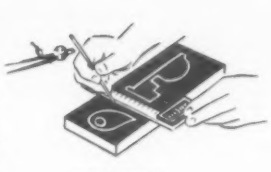
1. Has the rigidity of a machine tool.
2. Has a traveling work table.
3. Has centralized hydraulic controls.
4. Operates with minimum human effort.

AND it goes beyond a machine tool

1. Cuts every known material.
2. Has a wider range of tool speed.
3. Uses 27 kinds of cutting tools.
4. Saves time and material by cutting directly to a layout line.

Write for a demonstration—
See it work on your own jobs


Model MP-20
DoALL Contour-matic


TOOL STEEL

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The DoALL Company

Des Plaines, Ill., U.S.A.

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IN LESS THAN A YEAR FOR
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USE READER SERVICE CARD; INDICATE A-2-124-1

This is it!
This cross-section tells it's own story of how to save money on production drilling

Meyco Carbide Inserted Drill Jig Bushings

MEYCO bushings combine the best features of steel and carbide . . . the protection of steel with the long life of carbide at the points of wear. First cost: higher; end result: substantial savings in production costs. Made to ASA standards . . . MEYCO bushings will SAVE you money. Don't miss *this* bet! Many sizes now available from stock.

User Says:

"We have a jig setup where four holes are held to a limit of plus or minus .0005" on the spacing. MEYCO bushings were put into service . . . and, after completing 150,000 parts, the bushings show no appreciable wear."

Write for bushing catalog No. 13, for further details and a price list.

W. F. MEYERS CO., INC., BEDFORD, INDIANA

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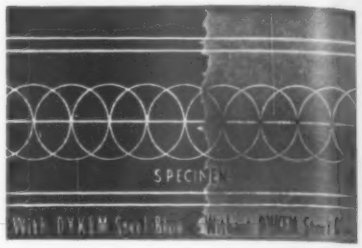
DYKEM STEEL BLUE

STOPS LOSSES
making dies & templates



Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout show up in sharp relief and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2303D North 11th St., St. Louis 6, Mo.

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MACHINES and TOOLS
FOR CUTTING
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in **GEAR PRODUCTION**

FELLOWS

THE FELLOWS GEAR SHAPER COMPANY, SPRINGFIELD, VERMONT

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Assured Accuracy with

TUKON TESTER *for* MICROHARDNESS TESTING

Researchers and scientists accept TUKON's precision and repeated accuracy

● Where minute indentations and extreme accuracy are necessary, the TUKON Microhardness Tester meets the most exacting requirements. A sensitive mechanically or electrically controlled system, with microscopic viewer, is employed.

On hardened steel, length of indentation with 100 gram load is .0016", depth only .00005"; very small metallic crystal areas can be tested. TUKON models are available for testing delicate watch parts to properly prepared specimens of heavy machinery parts. TUKON is necessary in every metallurgical department.

Information on the correct TUKON Microhardness Tester for your work will be sent on request. Just give us details of the job.

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AMERICAN CHAIN & CABLE
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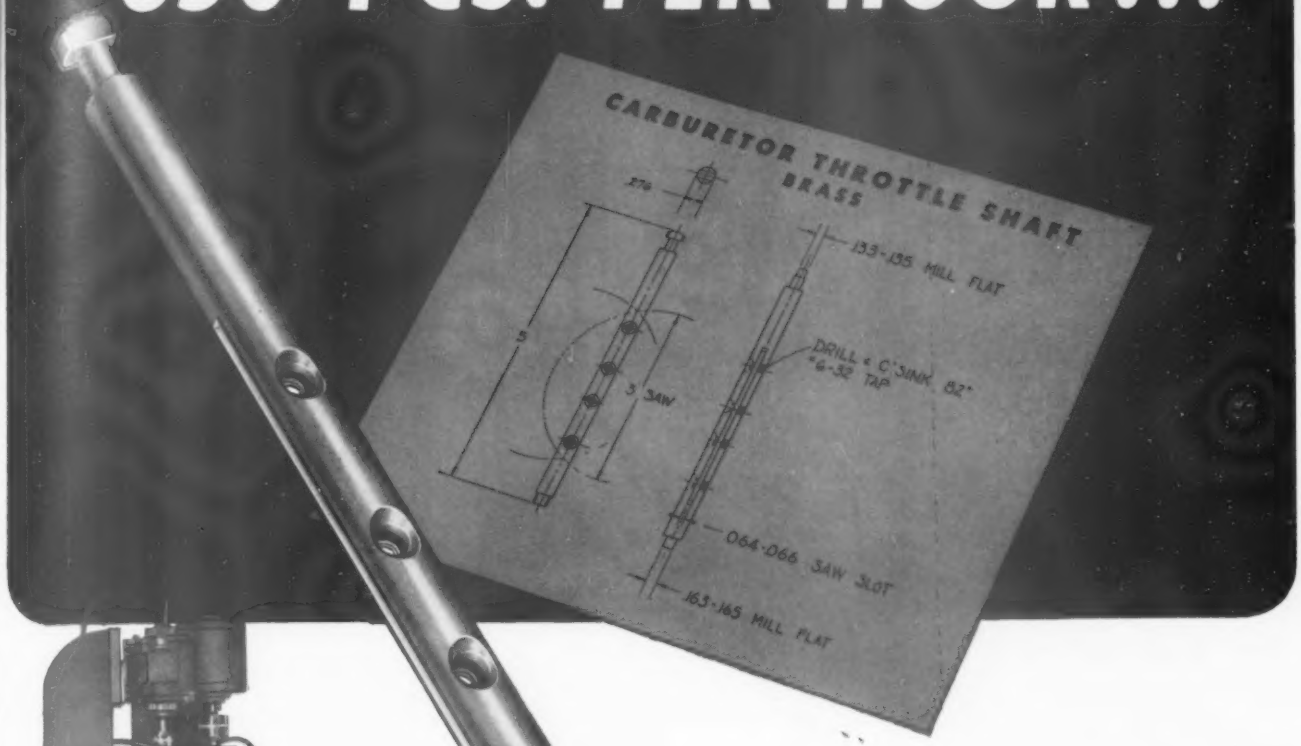
350 PCS. PER HOUR...



milled, drilled countersunk, tapped & slotted on this Hartford Special Automatic Drilling & Tapping Machine

Write for New Bulletin

THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD 12, CONNECTICUT

HARTFORD Special

H&G DIE HEADS

WITH INSERT CHASERS

FOR ALL MACHINES USED FOR CUTTING SCREW THREADS

The famous H & G Die Heads come in styles and sizes for all types of machines, including threading machines, chucking machines, drill presses, turret lathes, and automatic screw machines, such as Brown & Sharpe, Cleveland, Cone, Davenport, Economy, Foote-Burt, Greenlee, Gridley, Acme-Gridley, New Britain, New Britain-Gridley, Swiss, etc.

The small, inexpensive high-speed steel insert chasers are held by rugged carriers and cut threads straight and true to the close tolerances required.

The majority of expert production men prefer these die heads because of the ease with which insert chasers are resharpened and set, the low cost of insert chasers and the greater quantity of threads per grind and number of pieces threaded per chaser dollar.

The reduction in inventory will pay for new die heads. **For example:** If you have $1,000 in chaser inventory, changing to H&G will require only $300, setting free $700 for the purchase of new H&G heads. This is due not only to low cost of chasers, but to interchangeability and long life.

Check and Mail for Free Copy ☐ "Selecting Proper Die Head for the Job" ☐ Style MM ☐ Style DMS ☐ Style DM ☐ Style TM

THE EASTERN MACHINE SCREW CORPORATION

27-47 BARCLAY STREET NEW HAVEN, CONN.

Mfrs. General Purpose Die Heads, Insert Chaser Die Heads, Threading Machines.

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Specify CEMENTED CARBIDES ★ TANTUNG CAST ALLOYS

Our 24th Year V-R WAUKEGAN, ILLINOIS U.S.A. CEMENTED CARBIDES ★ TANTUNG CAST ALLOYS VASCOLOY-RAMET CORPORATION

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For
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Anti-Friction Bearings—High Speed—Carbide
IN STOCK or to SPECIFICATIONS

CENTER Specialists Since 1906

RED-E-TOOLS **THE READY TOOL CO.**

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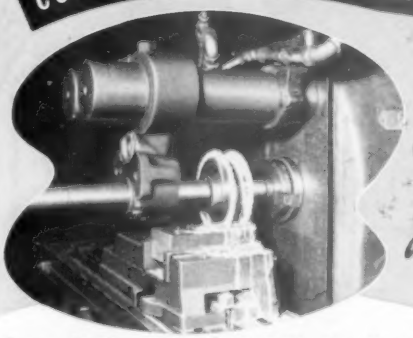
COME TO MOTCH & MERRYWEATHER



for a Complete Line of *Slitting and Slotting Blades*

Consult Your Local Distributor for Full Information

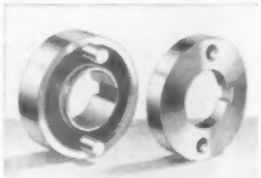
Yes, sir! a complete line in all diameters to meet every slitting and slotting requirement:

(1) ***Master-Cut***—a standard blade, for milling machine purposes generally.

(2) ***Triple-Chip***—a deluxe blade, for low cost operation and highest production *with accuracy*.

Also, special blades to order. Contact your local dealer or write us in Cleveland for full information.

Ask for Bulletin 250-T.



Dual Drive Adaptors optional on all M. & M. slitting and slotting blades. Dual Drive reduces stresses on driving means; makes possible blade interchangeability.

THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING • CLEVELAND 13, OHIO

COMMAND OUR UNPARALLELED EXPERIENCE IN CIRCULAR SAWING

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New! Low Cost!

BESLY No. 318—18"

Bench Grinder for light, free-hand work

This compact, handy and inexpensive vertical spindle grinder handles a large volume of free-hand work: castings, forgings, stampings, plastics, etc., where only a little stock removal is required. All grinding is done in a horizontal plane. This assures easier handling, more production and safer operation.

Complete with 18" diameter abrasive wheel, this grinder weighs 575 pounds. The height is 31" and the overall width, 28½". Because of its compact, rugged construction, it is easily mounted on a bench or stand of suitable height. Disc dressing is easily done by quick removal of a section of the guard rail to permit the dresser arm to swing across the face of the abrasive.

Keep your production costs down by drawing on Besly's more than 50 years accumulated experience in finding the best answers to all types of grinding problems. Write for Grinder Bulletin No. 318-18.

DIMENSIONS AND SPECIFICATIONS

DIA. OF STEEL DISC WHEEL	18"
ABRASIVE SIZE	18" dia., 1" or 2" thick
END THRUST ON CENTER OF SPINDLE	2000 lbs.
MOTOR	5 h.p., 1160 r.p.m., 220/440 volt, 3 phase, 60 cycle, totally enclosed, fan cooled, ball bearing, Fairbanks-Morse Axial Air Gap
DRESSER	Radial arm with ball bearing dresser cutters
WHEEL GUARD RING	Removable
EXHAUST PIPE OUTLET	4½" inside dia.
HEIGHT	31" to top of dresser arm 17½" to top of tub
WIDTH	28½" overall with dresser attachments 23½" dia. tub
APPROX. WEIGHT COMPLETE WITH ABRASIVE	575 lbs.
APPROX. WEIGHT CRATED	675 lbs.
OPTIONAL EQUIPMENT	Crossarm, pedestal, motor driven coolant pump, tank, and piping for wet grinding

BESLY-TITAN WHEELS

Just out — the new Besly-Titan booklet of abrasive wheels and discs — a valuable source of information on modern grinding wheels — up-to-date — authoritative. Includes full data on Besly-Titan Steelbacs that cut "down time". Write for your copy today!

BESLY

TAPS—the world's most accurate tap.

TWIST DRILLS AND REAMERS—Complete line for every need.

BESLY-TITAN ABRASIVE WHEELS AND DISCS—individually formulated for your job.

GRINDERS that reduce costs on every type of surface grinding.

CHARLES H. BESLY & COMPANY • 120 N. Clinton Street, Chicago 6, Illinois • Factory: Beloit, Wisconsin

Acme Offers
Complete Facilities for

PRECISION GRINDING

FAST SERVICE... LOW COST

- INTERNAL
- EXTERNAL
- CRUSH FORM
- CENTERLESS
- TWIN DISC
- SURFACE
- THREAD

Acme is equipped to handle all types of precision grinding. Expert craftsmen, using newest methods and modern equipment, will do the job for you faster, better, more economically. Acme also offers a flat lapping service that can finish surfaces to within millionths. Write for details.

Acme Industrial Company

Makers of Standardized Jig & Fixture Bushings

208 N. LAFLIN STREET • CHICAGO 7, ILLINOIS

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PRECISION BUILT ... to your blueprint

SPECIAL CUTTING TOOLS

High Speed Steel and Cemented Carbide Tipped

"BETTER" if it's made by FULLER!

SKILLED CRAFTSMEN

FULLER TOOL Co.

SPECIAL TOOLS • PRECISION MACHINING

GUILD

3956 WEST ELEVEN MILE ROAD
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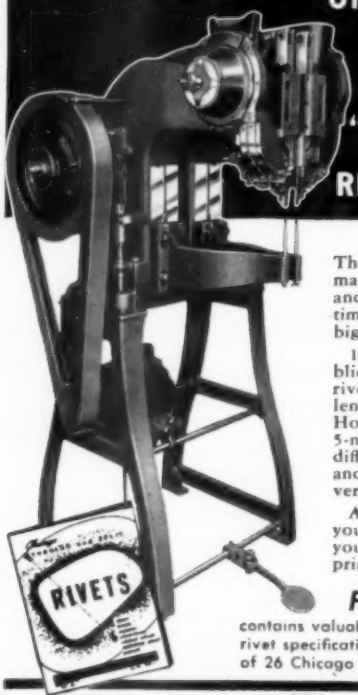
CUT COSTS... FASTEN "ON THE DOUBLE" with the Chicago "214" DOUBLE RIVET SETTER



The "214" automatically feeds, inserts and clinches two rivets at a time...with speed that may mean a big saving in your fastening costs.

14" throat makes large assemblies easy to handle. For tubular rivets as large as 9/64", or less in length. Quick Change Rotary Type Hoppers and Raceways permit a 5-minute changeover to rivets of different size. Adjustable anvils and riveting centers add to its versatility.

Ask us how the "214" can help you cut costs. Send a sample of your problem assembly (or blueprint) for a Free fastening analysis.

FREE CATALOG

contains valuable engineering information and rivet specifications plus illustrated descriptions of 26 Chicago Automatic Rivet Setters.

Chicago Rivet & MACHINE CO.

9619 West Jackson Boulevard, Bellwood (Chicago Suburb) Illinois

Branch Factory: Tyrone, Pa.

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Engineering and Design Service

Let Scully-Jones experienced engineers design your dies, fixtures, gages, jigs, machines, products and cutting tools.

COMPLETE SERVICE, DESIGNING AND BUILDING METHODS ENGINEERING, PROCESSING AND DRAFTING

Write or call Bishop 7-5907 for Bulletin No. 15-50 on Scully-Jones Engineering and Design Service. It shows how S-J engineers work in your plant or ours to save you time and money.

SCULLY-JONES and COMPANY

1915 So. Rockwell St. Chicago 8, Illinois

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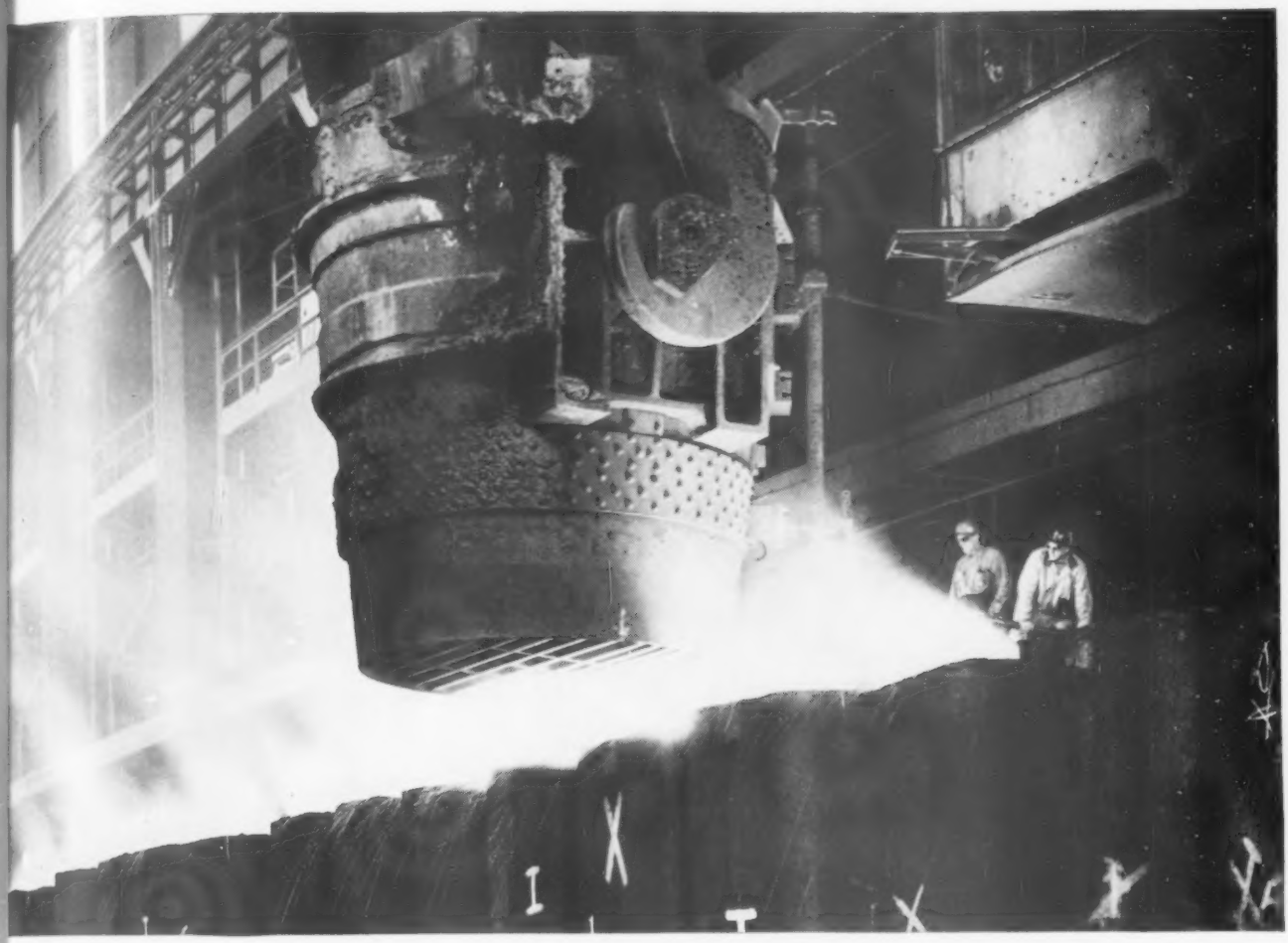
No Postage Needed



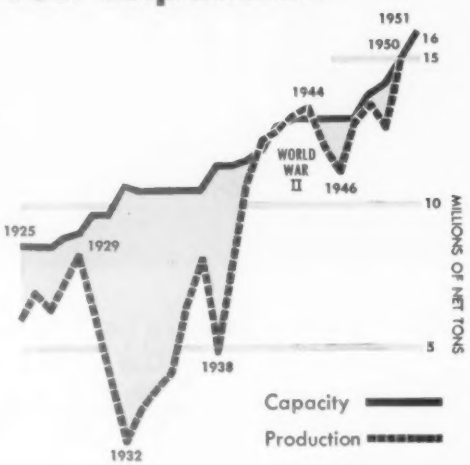
MILLION TONS MORE STEEL

Latest Increase in Bethlehem's Annual Capacity Climaxes 5 Years of Postwar 3,100,000-Ton Expansion

On January 1 of this year Bethlehem's steel making capacity stood at 16 million ingot-tons annually—*an increase of 1 million tons* over a year ago.

Since the war ended we have increased our annual steelmaking capacity *3,100,000 tons, or 24 per cent.*

Moreover, as the chart at the right shows, Bethlehem's steel capacity has nearly doubled in 25 years. Additional capacity can and will be created as it is needed.



BETHLEHEM STEEL ★ BETHLEHEM STEEL ★

WOODWORTH

DIAPHRAGM ARBOR

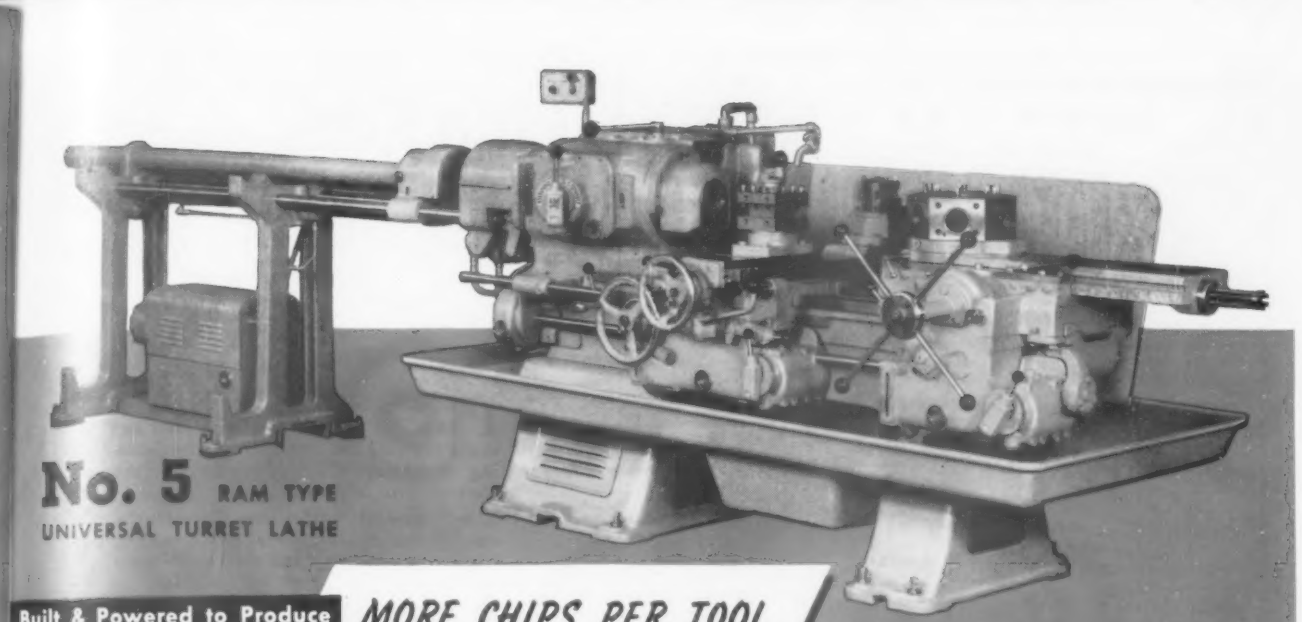
Precision TURNING HOBBING SHAPING GRINDING

For complete information
write for December issue
of NAWCO NEWS

WOODWORTH

N. A. WOODWORTH CO., 1300 EAST NINE MILE ROAD • DETROIT 20, MICHIGAN

COMPLETE LINE OF PRECISION GAGES • DIAPHRAGM CHUCKS • CONE-LOK JIGS



No. 5 RAM TYPE
UNIVERSAL TURRET LATHE

Built & Powered to Produce

MORE CHIPS PER TOOL
MORE PIECES PER HOUR
MORE PROFIT PER JOB

than any other turret lathe of comparable size

Jones & Lamson offers the best investment in turret lathes. They are backed by the "know how" of a firm, long predominant in the field, whose many pioneered and perfected developments have brought about far-reaching advances in the art of cutting metal.

Every feature of these lathes has been developed through long-range research and practical experience in production turning. Their superior performance stands out over any other machine of comparable size, because they are built to hold their accuracy at the highest speeds and feeds possible with modern cutting tools — with ample reserves to anticipate new cutting techniques. Jones & Lamson Turret Lathes have a well-earned reputation for ease of operation, low operating costs and year-round dependability. They are recognized for their advantages in *SPEED, POWER, RIGIDITY AND REPETITIVE ACCURACY.*

They will pay for themselves quickly through savings in direct costs alone!

- Single lever speed selector — 12 spindle speeds 30 to 1500 RPM or 20 to 1000 RPM
- 15 HP constant speed motor — ample horsepower available at all speeds
- Single lever carriage feed selector — 9 reversible longitudinal and 9 cross feeds
- Single lever hexagon turret feed selector — 9 longitudinal turret feeds
- All longitudinal and cross feeds automatically disengaged against positive stops
- Heavy-duty spindle mounting with rugged preloaded anti-friction bearings
- Heat-treated, precision-finished, long-wearing alloy steel gears
- Multiple-disc type forward and reverse clutches — automatic spindle brake
- Husky, multiple-spline transmission shafts with anti-friction bearings
- Hardened and precision ground steel ways — $12\frac{1}{2}$" in overall width
- Bridge-type carriage for multiple tooling at rear of cross slide
- 4-position, quick-indexing square turret — all faces tapped for extra tool blocks
- Hexagon turret clamped automatically on forward stroke of ram
- Automatic lubrication system with forced feed to all sliding bearings
- Complete coolant system — automatic internal delivery to each hexagon turret face
- Adjustable graduated handwheel dials and clips and chrome plated handwheels, dials and levers

Write to Dept. 710 for Complete Information

Turret Lathe Division **JONES & LAMSON**
MACHINE COMPANY
Springfield, Vermont, U.S.A.
MACHINE TOOL CRAFTSMEN SINCE 1835

Severance CUTTING TOOLS HIGH SPEED CARBIDE

MIDGET MILLS - ¼" Shanks
GROUND-from-the-Solid

TEN LEADERS
MORE THAN 20 SHAPES--EACH IN SEVERAL SIZES

Obtain the best from the originator of GROUND-from-the-Solid

Severance JUNIOR MILLS-⅛"Shanks
GROUND-from-the-Solid

Practical for use on small grinders, for finishing Patterns, Dies, Parts, etc., in places difficult to reach with the larger Mills.

SPEED and CARBIDE

Truly REVOLUTIONARY Cutting Tools

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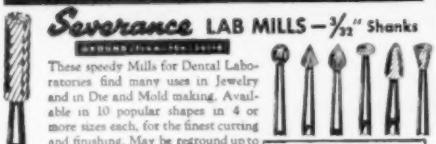
GROUND-from-the-Solid

These speedy Mills for Dental Laboratories find many uses in Jewelry and in Die and Mold making. Available in 10 popular shapes in 4 or more sizes each, for the finest cutting and finishing. May be reground up to 8 times per Vss" reduction in diameter



Write for Catalog No. 18

HIGH SPEED
Out-Perform Dental Burs and Grinding Points

Complete REGRINDING Service — by New Tool Craftsmen
— Savings are thus multiplied —

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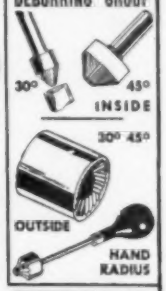

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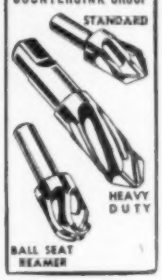

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PRODUCTION time and money can be saved in making chuck jaws and nests for dial feeding stations for holding irregular shaped pieces by the Cerromatrix Method.

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Write for Bulletin B-5—How To Make Chuck Jaws.

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Are Best for You!

You're sure of a longer lasting, better working coolant pump when you specify Ruthman Gusher Coolant Pumps on your machines.

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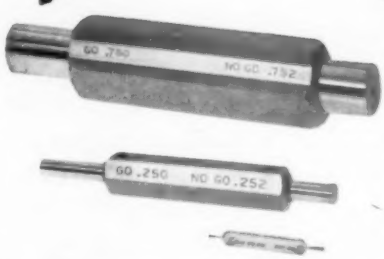
Carboloy
Chromium Plate
High Speed Steel
Alloy Tool Steel



Full 1⅞" and 2" length units may be cut to make 2, 3, or 4 gages . . . Always accurate. No rejections. Long life aluminum handles. Prompt delivery from a stock of 2 million wires.

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This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.
It presents for the first time in history a simple and exact method of measuring screws and worms with wires.
It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.
Copies free upon request.

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32nd YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Measuring Wires • Carboloy Plug Gages.

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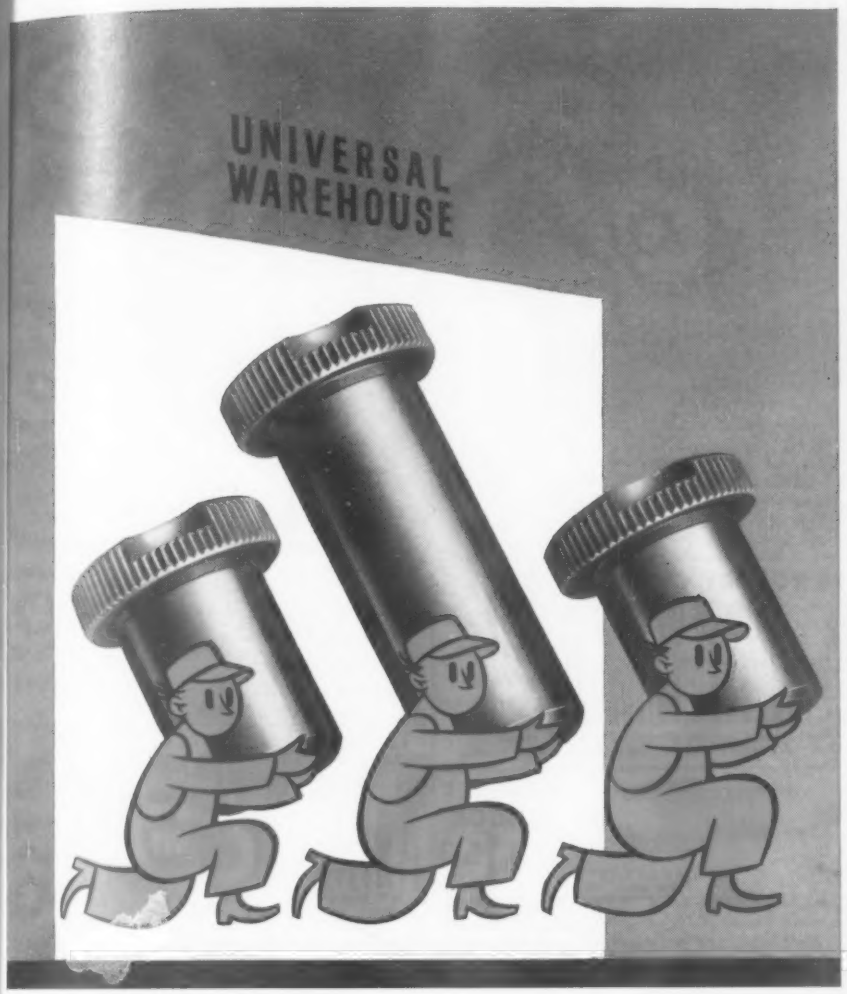

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BRAND NEW PERFECT FIRST QUALITY MOUNTED ON ⅛" STEEL MANDRELS

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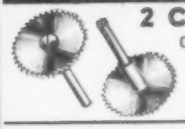

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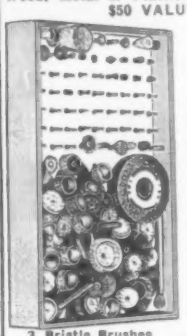

1 High Speed Steel Rotary File
3 Grinding Wheels 1 to 3" in diameter
12 Mounted Stones 1/8, 3/32, 1/4" Shanks
9 Rotary Cutters 1/8 and 3/32 Shanks
30 Miniature Rotary Cutters 3/32 Shank
10 Cut off Discs and Grinding Wheels
1 Drum Sander 1/8 Shank
15 Abrasive Bands for Drum Sander
15 Leather and Felt Polishing Wheels 1/2 to 1" in diameter
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25 Abrasive Sanding Discs 1 1/2 to 2" diameter
3 Rubber Wheels 7/8" diameter
2 Speed Drills 3/32 Shank
2 Mandrels 1/8 and 3/32" Shanks
3 Bristle Brushes
1 Rotary Wire Wheel Brush
1 Circular Saw on Mandrel 1/8" Shank
2 Rubber Cylinders with 3/32" Mandrels
150 other items—all new and valuable

12 MINIATURE CUTTERS

For Cutting Wood, Plastic or Metal. Actual size. Asst. shapes on 3/32" shank. For die makers, home workshops, etc. Postpaid in U.S.A. **$1.00**

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7 HIGH SPEED STRAIGHT SHANK DRILLS—ONLY..... $1.00

15 Drills for only $2.00 Order Today!
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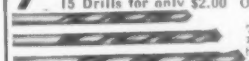
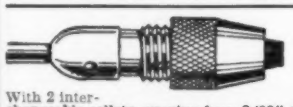


7 Popular Sizes — up to ¼". Brand new, ideal for home or shop use. Fits all standard chucks.

2 DRUM SANDERS WITH 12 BANDS IN ASSORTED GRITS

½" dia. x 1" on ⅛" arbor with twelve bands..... **$1.50**
1 Drum, 1" Dia. x 1" and 6 sleeves on ¼" arbor **$1.00**



ADAPTER CHUCK $1.50 Postpaid

With 2 interchangeable collets, opening from 3/32" to 0, on 3/32" mandrel. Price each, only

12 MOUNTED WHEELS & POINTS

on ⅛" Mandrel. For grinding on plastic, wood, soft and hard metals, glass, etc. Regular $8.40 list value....ONLY **$2.95**

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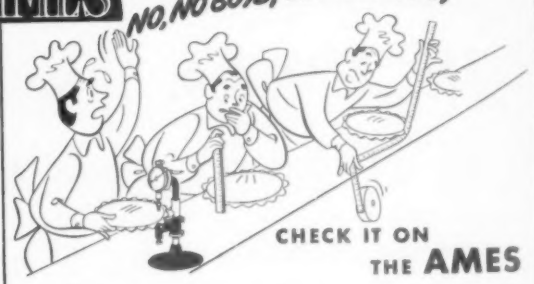
AMES



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A cost conscious restaurateur actually employs an Ames Thickness Measure to hold pie crust thickness to a uniform standard, thereby cutting down raw material waste, lowering fuel costs and assuring top quality pastry day in and day out. This unusual solution to a measuring problem is illustrative of the creative thinking of Ames engineering and design department. They'll tackle any measuring problem you may have and come up with a sound answer that will improve your quality control. Ames has built gauges to measure the thickness of potato chips, soap flakes, enamel on teeth, as well as gauges that check the sway of buildings, the stretch of bolts plus many others that solve successfully unusual and difficult applications. If you are puzzled and want an economical answer to a measuring problem, send it to B. C. Ames today.

Ames No. 1 Dial Comparator — measures objects up to 2" in cross section. Adjustable table with positive locking screw. Height 9½", weight 4 lbs., Dial Indicator graduated .001", with .250" range

Representatives in principal cities. **B. C. AMES CO.** *30 Ames Street, Waltham 54, Mass.*
Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

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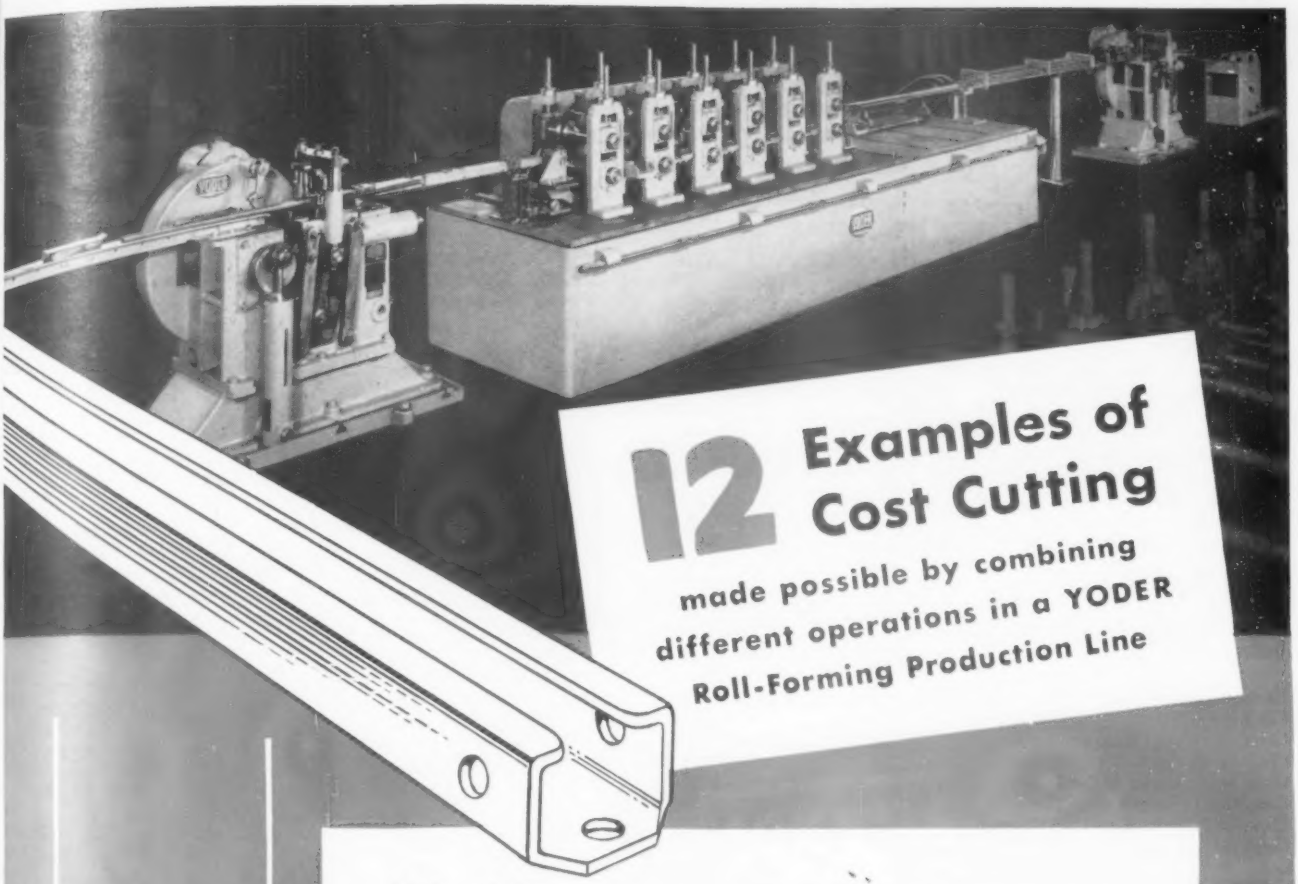

12 Examples of Cost Cutting

made possible by combining different operations in a YODER Roll-Forming Production Line

NO. 10 Notching; Punching Holes; Stamping Name; Roll Forming and Cutting-to-Length

Here's a steel channel, the main part of a patented mirror support —a big improvement on the conventional wood strips for fastening mirrors to the backs of dressers and other furniture. The first three operations are done on the flat strip, as shown in drawing below, in a Yoder automatic shear type press, placed between the coil box and the Yoder roll forming machine. After forming, the finished shape is cut-to-length in a Yoder Automatic Cut-Off Machine.

All five operations are performed continuously, in a line of four units just mentioned, tended by a single operator. The speed is 60 f.p.m., equivalent to a net production of about 3000 pieces per hour.

Yoder roll forming production lines may also include auxiliaries for embossing; coiling or curving; making overlapping, open or closed seams; welding; inserting rubber or felt; filling powders, or injecting liquids into tubular sections, etc.

Yoder engineers are at your service, without cost or obligation, in working out production problems involving such operations. Send for 88-page Book of Information on Cold Roll Forming.

THE YODER COMPANY • 5525 Walworth Avenue • Cleveland 2, Ohio

Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS–cold forming and welding

ENGINEERING YODER MANUFACTURING

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FEBRUARY, 1951

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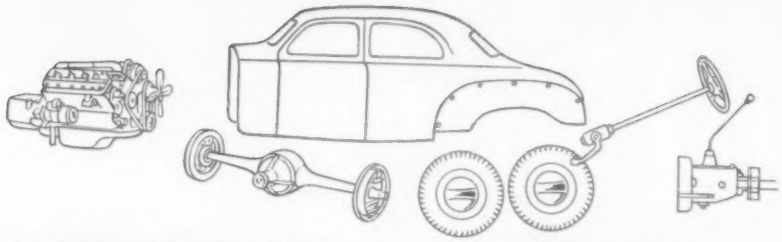

YOU WOULDN'T buy a car this way

...so why buy hydraulics piecemeal

VICKERS Custom Built HYDRAULIC POWER UNITS

When you buy an automobile you don't make separate purchases of engine, fenders, wheels, frame, axles, gear box, windshield, etc. and try to put them together. You buy a complete car, all in one piece. You don't want the expense and trouble of making the assembly. You do want the undivided responsibility of manufacturer and dealer for the complete car.

Why, then, buy hydraulics piecemeal when you can get a Vickers Custom Built Hydraulic Power Unit? It is built to meet your individual requirements. All necessary pumps, valves, intermediate piping, oil reservoir, motors, controls, etc. are in one self-contained "package." It includes all needed hydraulic accessories such as oil filters, air cleaners, oil level gauges, fittings, etc. Hydraulic connections are grouped in a conveniently located manifold.

The result is simplification of hydraulic design and substantial savings in installation and maintenance costs. Undivided responsibility of Vickers for the entire hydraulic system is an important advantage to both the machine builder and his customer. • *Write for Bulletin 50-61.*

VICKERS Incorporated

DIVISION OF THE SPERRY CORPORATION

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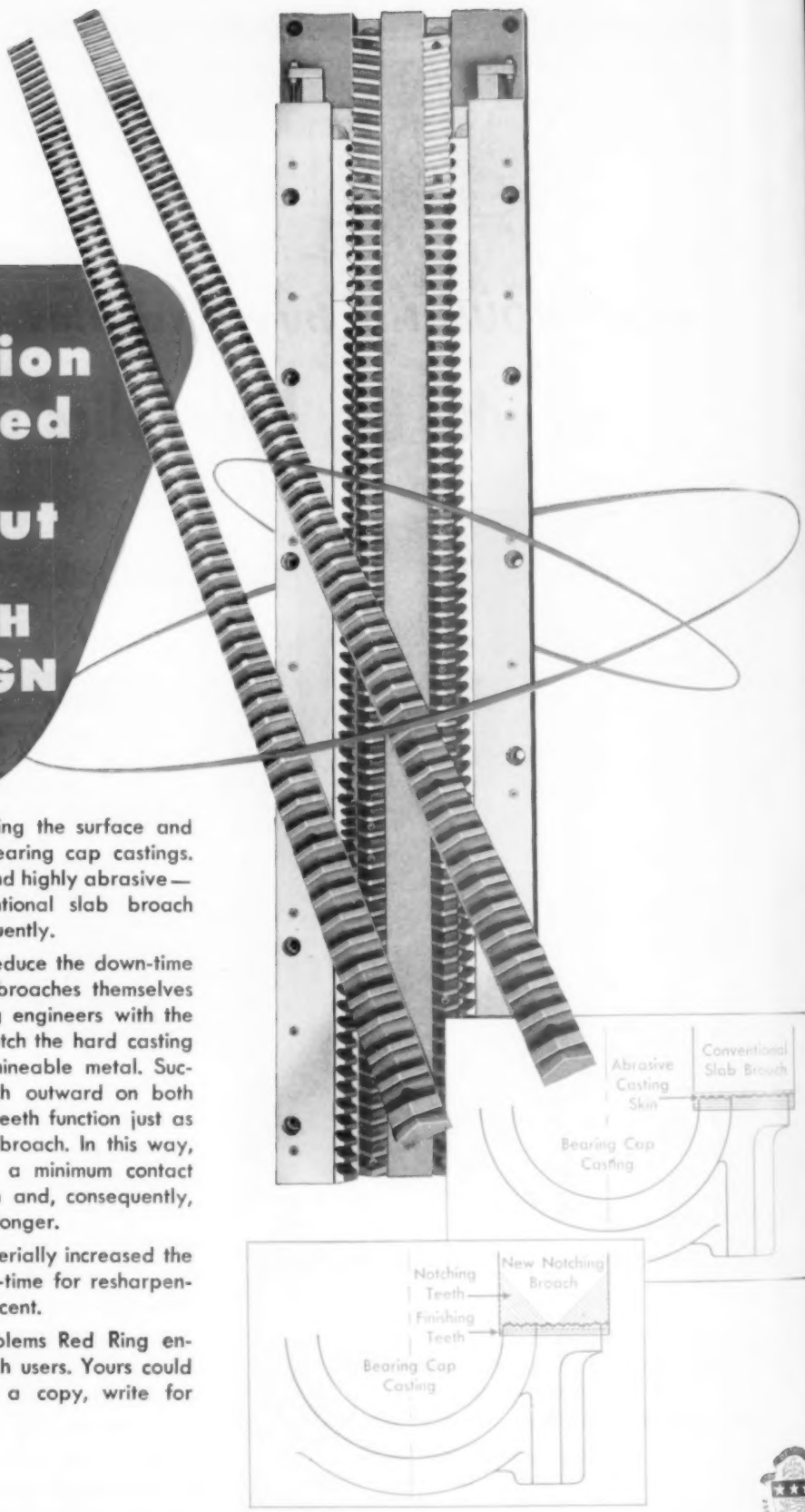
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

4315

Production increased and costs cut by BROACH REDESIGN



The job in question is broaching the surface and edges of automotive main bearing cap castings. The surface skin is very hard and highly abrasive—so much so that the conventional slab broach requires sharpening very frequently.

To get more production and reduce the down-time for regrinding broaches, the broaches themselves were redesigned by Red Ring engineers with the forward teeth V-shaped to notch the hard casting surface down to readily machineable metal. Successive teeth extend the notch outward on both sides while the final finishing teeth function just as those of a conventional slab broach. In this way, broach teeth are exposed to a minimum contact with the abrasive casting skin and, consequently, hold their cutting edges much longer.

These new broaches have materially increased the parts per grind and the down-time for resharpening has been reduced 70 per cent.

This is one of the many problems Red Ring engineers have solved for broach users. Yours could be the next. If you haven't a copy, write for Bulletin 49-11 on broaching.

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

5643

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMEN

ADD FLEXIBILITY TO YOUR SURFACE GRINDERS WITH

EX-CELL-O

PRECISION SPINDLES

Ex-Cell-O 1 horsepower, 3600 rpm inbuilt motor spindle for surface grinder. Spindle swivels vertically, is used for sharpening cutters and broaches.

Standard horizontal Ex-Cell-O Precision Spindle with 1 horsepower, 3600 rpm inbuilt motor for surface grinders. Standard Ex-Cell-O belt-driven spindles also are available for this type of grinder.

This Ex-Cell-O High Speed Attachment drives small wheels at 18,000 rpm. It is driven by the standard motorized spindle and is supported by the standard spindle or spindle bracket.

You can add to the flexibility of your surface grinders, and perhaps save the cost of another machine, with Ex-Cell-O spindle equipment. For instance the large photo at left shows an inbuilt motor spindle that swivels vertically. It makes a standard surface grinder suitable for sharpening cutters and broaches. A mounting member extends through bore in column that ordinarily houses the standard horizontal spindle.

The Ex-Cell-O High Speed Attachment also adds to the flexibility of surface grinders. This attachment mounts on the standard horizontal spindle or spindle bracket. The standard surface grinding wheel is replaced by a pulley that, through a flat belt, drives the high speed spindle at 18,000 rpm. Thus, small wheels can be driven at an efficient speed for grinding small shoulders, slots and other hard-to-reach places.

For rigid, smooth-running spindles that require no further lubrication or adjustment, and produce fine work day after day, contact your Ex-Cell-O representative or write to Ex-Cell-O Corporation in Detroit.

Send today for Ex-Cell-O's free Precision Grinding Spindle Catalog, Number 25962. No obligation, of course. Just use your company letterhead.

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